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EDITORIAL

MILK—A NEW OBSERVATION

OBSERVERS have noted that in districts where the incidence of malaria is great amongst the population, infants up to the age of about three months seem to escape infection, but thereafter the percentage of the infected rises rapidly until the age of nine months practically all have the disease. Many theories have been advanced to explain this phenomenon but one factor cannot be considered an explanation; the vector can have no compassion for infants for the mosquito is no respecter of persons. The mother's milk itself may give protection from infection, this may be nearer the truth in this disease than the idea that immune bodies are acquired during the intra-uterine life.

As a result of observations by Professor Macgraith and his colleagues, during the course of experiments on the metabolism of hæmoglobin derivatives in rats infected by blood passage with *P. berghei*, it was noted that whilst using a diet of milk to which minimal quantities of vitamins B_1 and B_6 and calcium pantothenate had been added, the animal became resistant to infection with the rat malaria parasite (*British Medical Journal*, December 27, 1952, p. 1382). Now this is an important observation and one which may have repercussions of great moment in the conquest of disease. The food value of milk has been recognised for a long time as being greater than its chemical constitution alone would warrant; in other words its nutritional standard is beyond what one would be led to believe by a study of its chemistry alone.

(The January issue of The Veterinary Journal was published on January 19)

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In the field of veterinary science we have examples of the value of milk going beyond its pure chemical analytical standard. Calves that are reared on their mother's milk, especially if taken in the natural way, grow better and are healthier than those reared on a nurse cow or on mixed milk from several cows. All do better than those reared on synthetised milk. In the experiments we have mentioned, it was found that the activity of the milk was observed also in pasteurised and in dried milk; human milk which had been stored in the deep freeze was active as well. It is possible that the malaria parasite is denied essential nutrients when a pure milk diet is given; supplements could nullify this by supplying the parasite with what it needs. Whatever the explanation, one principle is again emphasised; natural phenomena afford protection to the young and this is clearly evident when the young mammal is called upon suddenly to exist alone and away from the protection of the mother's uterus. The transition period from birth to weaning is a hazardous one in all animals and many adjustments have to be made. Our imperfect knowledge does not always give assistance to the young and we are persuaded to modify our methods of husbandry when greater knowledge would bid us otherwise. The rapid removal of the young from its mother, the substitution of synthetic for natural foodstuffs and the practice of prepartum milking are dictated by economic considerations. The results obtained may not be economical and the disturbance of natural phenomena and of the natural sequence of events may lead to evil consequences. We do not realise or understand all the factors at work and at the moment the mechanism of this activity of milk is an unknown one. It is improbable that antibodies are responsible for this phenomenon in rat malaria and the observations recorded are unlikely to be confined to malaria or even to protozoan infections. There is some suggestion of a protective action of milk against virus infections and against the growth of bacteria in the intestine.

A new field for research and study is revealed and one more reason may be given for the value of milk to the young. There is thus a lesson and a stimulus embodied in these observations, which may have a profound bearing on current thought and practice, especially in the feeding, care and protection of young stock.

GENERAL ARTICLES

THE PELVIS AND CALYCES OF THE KIDNEYS OF SOME MAMMALS

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THE pelvis, calyces, ureter and collecting tubules of the kidney arise from the metanephric duct, a small hollow outgrowth from the mesonephric duct near to where it joins the urogenital sinus. This metanephric duct extends into the nephro-genic mesoderm, in which the uriniferous tubules will develop to unite with the distal end of the metanephric duct, to form finally, the permanent kidney. The distal end of the metanephric duct, the end distant from its origin, is dilated to form the lining of the pelvis of the kidney, or branched to form calyces, or a combination of both pelvis and calyces. The dilated part of the metanephric duct or ureter is the pelvis of the kidney, from which arises the collecting tubules which branch and rebranch to become fused with the uriniferous tubules.

The great variation in behaviour of the distal end of the ureter, in the different species of mammals, invites the making of a comparison of these structures.

Method

The kidneys of any available mammals were collected from various sources. The ureters were injected with celluloid or one of the resins, using a little pressure by gravitation or a syringe. The kidney tissue was then disintegrated with acid, and a cast of the pelvis remained. Drawings and photographs have been made on which the subsequent descriptions are based.

Observations

Horse (*Equus caballus*) and the other members of the family *Equidæ* have a characteristic termination to the ureter within the renal sinus. The pelvis is dorso-ventrally flattened and funnel shaped, and forms a middle recess into which the central renal tubules open. The tubules which form the extremities of the kidney open into the diverticuli constituting the terminal recesses, which project from the pelvis into the extremities of the kidney.

The renal papillæ of the renal pyramids fuse to form a crescentic-shaped renal crest. The crest is wider in the right kidney than the left. A well injected specimen will show each terminal diverticulum completely surrounded by innumerable uriniferous ducts.

The Dog (*Canis*), *Cat* (*Felis*), *Camel* (*Camelus bactrianus*), *Deer* (*Rangifer tarandus*), and *Sheep* (*Ovis*) have a similar type of termination of the ureter within the renal sinus. There is a flattened dilation which forms a distinct pelvis,

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and from which projections extend outwards. The edges of these projections usually turn over to enfold the blood vessels. Between the projections are spaces into which the lateral medullary renal substance extends. The enfolding is not so obvious in the cat. The area between the pelvic projections of either side accommodates the renal crest, from which the urine drips into the pelvis. As in the horse, the crest is formed by the fusion of the renal papillæ. The number of projections varies in different species. The dog and sheep have four or five projections, the cat two or three, the reindeer four, and the camel eight or more. The kidneys of all these animals are bean-shaped, and the extremities fit into a space at either extremity of the pelvis.

Man (*Homo*) *and Pig* (*Sus*). Each of these animals has a flattened renal pelvis, and from the pelvis the two major calyces arise, each dividing into several smaller branches, the minor calcyes, which receive the excretion from the renal papillæ. There are eight or more calyces, and each calyx may accommodate two or three papillæ. There is little to distinguish these two structures.

The pelvis of the pig may have a larger number of minor calyces, and these are usually more irregular in appearance. The number of renal pyramids which form a renal papilla varies in the human kidney. The central part of the kidney may have two or three pyramids to a papilla, and at the extremities of the kidney six or more pyramids to each papilla. In the pig there is a similar fusion of pyramids, but the kidney is larger and there are more pyramids, and therefore there are more papillæ and more calyces to receive the excretions. The pelvis of the pig's kidney has a more irregular appearance, due to some of the papillæ projecting directly through its wall.

Ox (*Bos*). It is remarkable that the termination of the ureter in the ox is so different from the other members of the ruminant group that have been examined—sheep, goat, camel and deer. In the ox the ureter does not form a pelvis, but divides on entering the sinus into two main branches, the major calyces, each branch sub-dividing into minor calyces. The end of each minor calyx is dilated to receive one or more renal papillæ. These small, cup-like dilations, with short narrow stems, are mostly in groups of three or four. A longitudinal section of the kidney of an ox shows the fusion of the renal pyramids very clearly. Two or three pyramids may fuse to produce a renal papilla, or a papilla may be formed entirely by a single pyramid. This type of formation of papillæ, by single pyramids with their surrounding cortical tissue, is reminiscent of the embryonic picture, and it is still emphasised by the surface lobulation, and may be of some phylogenic significance.

Bear (*Ursidæ*). The pattern of the terminal end of the ureter of the bear diverts as much from that of the carnivora as does that of the ox from the general ruminant pattern. There is no pelvis, and the arrangement is similar to that in the ox; two major calyces with many minor calyces.

The brown bear (*Ursus arctos*) and polar bear (*Ursus maritimus*) have a similar design of calyces. The perceptible differences are in the minor calyces. In the brown bear they are small and numerous, whereas the minor calyces of the polar bear have longer stems, are less numerous, and the calyces are

much larger. These patterns indicate that in the kidney of the polar bear there is more fusion of pyramids or the pyramids are larger. In the brown bear the fusion is less, giving the impression of the persistence of reniculi. This suggestion is supported by the lobulation of the kidney, which is reminiscent of the lobulation of the ox's kidney, except that in the latter the lobules are larger. It has been customary to appreciate two types of calyces in the pelvis of the human kidney, and similarly in the pig and several other animals, but these structures are not strictly calyx-like as compared with those structures in the ox, bear, seal, etc. Perhaps it is from the shape of these forms that the use of the term calyx arose. The suggestion made in this article is that the ureter in many animals such as the ox, bear, etc., initially forms two large major calyces, and that of each major calyx there are several large divisions into which the minor calyces open. These secondary large divisions could well be defined as intermediate calyces. A minor calyx is the cup-like expansion with the stem attached. It perhaps would have been better to have established a different system of nomenclature, to have confined the term calyx to the cup-like expansion, and to have described a system of ducts.

In the bear, the average number of minor calyces which open into an intermediate calyx is three, occasionally more, and sometimes less. It is of some interest to notice that each intermediate calyx has a large satellite artery, which usually divides into the same number of branches as there are minor calyces. Each of these branches divides into an arborescence of small branches which surround and project beyond the cup. The veins behave in a similar manner. There is no difficulty in recognising the lobulation of the kidney by the examination of a vascular coat.

Casts have been made of the kidneys of the following sea mammals: Northern sea lion (*Otaria stellari*), common seal (*Phoca vitulina*), and the bottle-nosed whale (*Hyperoodon rostralus*).

The ureters of the sea lion and seal have very similar terminations in the substance of the kidneys. Both animals have lobulated kidneys deeply buried in fat. The sea lion's kidney is, as would be expected, larger, and therefore there are more lobules, all of which are of the same size. The ureter has no pelvis. There are two major calyces from which branch many intermediate calyces of varying size, and from these lead smaller tubes into which minor calyces open. It will be observed that in these specimens there is a further division of the intermediate calyces. The minor calyces are in groups of from two to six, and the cups are small and have the shape of a chalice. The grouping of the renal papillæ hints at the possibility of some fusion, but this in fact never appears to be effected.

The Bottle-nosed Whale. This was a young animal, about 25 ft. long, and the kidneys were not too large for our purpose. Two very good casts were obtained showing several interesting features. The kidney is lobulated, elongated, and is of the usual colour of a normal mammalian kidney. The artery and vein form a hilus at the cranial extremity, and the ureter leaves by the caudal extremity. The artery immediately meets the termination of the ureter,

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and follows the ureter almost to the entrance, where it breaks up into numerous ramifications. The ureter travels through the median plane of the kidney in an irregular fashion, with small dilations at varying intervals, and ends within the cranial extremity in a slight expansion. Throughout its course it gives off branches on all sides, some sub-dividing several times before the minor calyces are detached. It will be seen from the drawing that there are no major calyces or pelvis, the ureter continuing through the kidney with more or less the same diameter, and ending in a round dilation. The minor calyces have a curious distribution, grouped in fours and threes, back to back, and forming a " cluster." When they end thus the stems are short, giving the " Cups " a sessile appearance. The " Cups " are mostly in twos, rarely singly. A division of an intermediate calyx may carry as many as 20 minor calyces grouped as indicated. These groups are usually well defined, giving the appearance of lobation, which is emphasised by the vascularisation of these areas. Accompanying the intermediate calyx is an artery which breaks up into the corresponding number of intermediate derivatives, and each branch finally forms a tuft of small capillaries round and beyond each " Cup."

The " Cups " are wonderfully similar in size and shape, possessing a central cavity which opens into the hollow stem.

The grouping, arrangement, and back-to-back disposition of the minor calyces indicates the plan of the renal pyramids, and also their individuality or reniculus formation. The clustering of pyramids and papillæ in selected areas, not only suggests the individuality of the pyramid but of the area. An area or lobe could have 60 or more " Cups," and each area is drained by a single intermediate calyx..

The Indian Elephant (*Elephas indicus*). An article by me appeared in this Journal, Vol. 100, No. 5, concerning the kidney of this animal. The knowledge since acquired in the examination of the termination of the ureters in many mammals suggests a slight alteration of the terminology used to describe the divisions of this ureter. It would be better to consider three major calyces giving origin to 10 intermediate calyces, from which arise the minor calyces with a recess to receive urine. This change of arrangement of terms would bring them to correspond to those terms used in this article for the ureters of the other animals described.

Summary

(1) Phylogenic characters of the kidney are exhibited in the marine mammals and emphasised by the method of division of the ureter.

(2) The members of the ungulate family Bovidæ examined, have marked differences in the divisions of the ureter. The same statement may apply in respect to the members of the Carnivora.

(3) The anatomical evidence suggests the use of " Intermediate Calyx " to define the additional calyx, and consequently to enable the divisions of the ureter to be more clearly understood.

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PLATE I

FIG. 1
Dog.

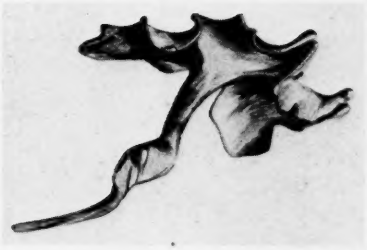

FIG. 4
Reindeer.

FIG. 2
Cat.

FIG. 5
Sheep.

FIG. 6
Man.

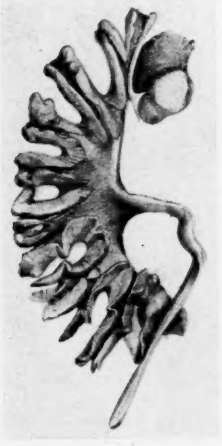

FIG. 3
Camel.

FIG. 7
Pig.

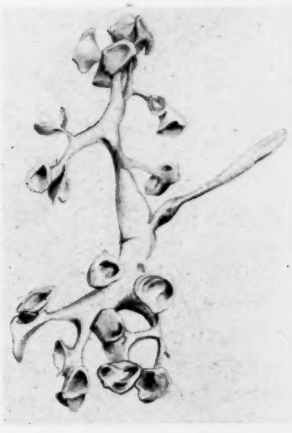

FIG. 8
Ox.

(*Article by Grahame, page* 51)

PLATE II

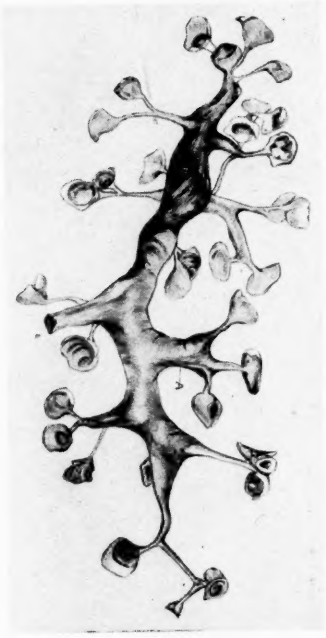

FIG. 9
Polar Bear.

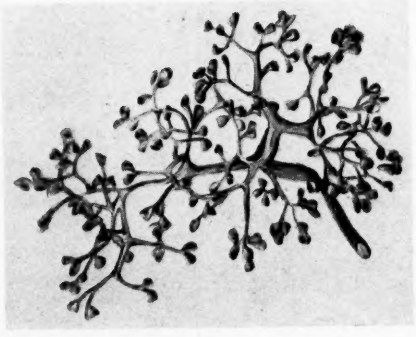

FIG. 10
Northern Sea Lion.

FIG. 11
Common Seal.

(*Article by Grahame, page* 51)

PLATE III

FIG. 12
Bottle-nosed Whale.

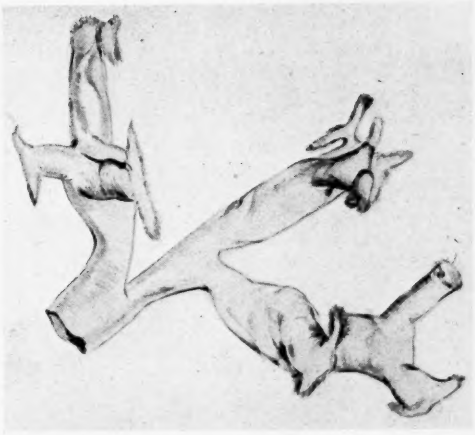

FIG. 13
Elephant.

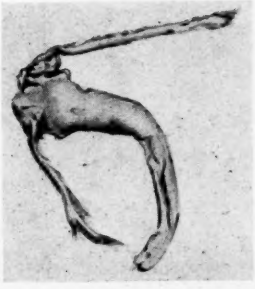

FIG. 14
Horse.

(*Article by Grahame, page* 51)

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PLATE IV

FIG. 1

FIG. 2

FIG. 3

(Article by Wilkinson, page 55)

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Acknowledgments

It is with pleasure I recognise the technical assistance of Mr. E. Roberts and his staff in the preparation of the casts. My thanks are also due to Mr. I. A. Anderson, who was responsible for some of the drawings.

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THE PATHOLOGY OF NAVICULAR DISEASE

By G. T. WILKINSON, B.V.Sc., M.R.C.V.S.

Part II.—The Histopathological Features of the Disease

In the early stages of the disease, the fibro-cartilage of the tendinous surface of the bone, often shows a macroscopic brownish discolouration as mentioned above. Histologically this discoloured area shows thinning of the fibro-cartilage and a disappearance of the cartilage cells from the more superficial zones. The thinning of the cartilage apparently occurs mainly by the encroachment of new bone from the sub-chondral region, but the zone of calcified cartilage retains its depth, and thus occupies a larger proportion of the total depth of the cartilage as the bony encroachment advances. In addition, the matrix of the non-calcified fibro-cartilage appears to be compressed and somewhat denser, and stains more deeply than the neighbouring normal fibro-cartilage. There is a definite depression of the line of the bursal surface of the tendinous surface, when passing from the normal to the "thinned" area, which gives the impression of having been "pushed-in."

A similar discolouration occurs in the area of the Flexor perforans tendon, which is in contact with the affected area of the tendinous surface. Histologically, this is revealed as an area of necrosis and partial hyalinisation of the tendon bundles. The cells have all disappeared from the affected area, and the collagen bundles of the tendon appear to have become confluent and form an eosinophilic, homogeneous mass. The necrotic area is not confined to the superficial portion of the bursal surface of the tendon, but extends for some little distance into the substance of the latter. The change is, however, confined to the area of contact with the tendinous surface of the bone.

The next stage seen macroscopically, was the appearance of small, "punched-out" erosions of the fibro-cartilage of the tendinous surface. Histologically these appear to be formed in the following manner:

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In the affected area of cartilage, whorls of the matrix appear to be undergoing in necrosis. There is a loss of staining power, and later the affected portion fragments and becomes disorganised, leaving a circular cavity in the cartilage. These whorls are usually situated just above the zone of the calcified cartilage. The cavities thus formed may remain as such for some time, but pressure from the tendon often breaks down their thin roofs and the "punched-out" appearance results. The vessels of the sub-chondral plexus are rather congested at this stage and the bone here may show definite osteo-porosis. Where the erosion has been formed, bony projections appear from the sub-chondral bone and encroach on the base of the erosion. These bony encroachments probably account for the descriptions of small calcareous spots in the macerated bone, which are encountered in the works of other authors, e.g., Williams (1864) and Smith (1893).

Meanwhile changes are occurring in the region of the foramina and the vascular channels entering the bone via the lower edge. The channels show erosion of the bone substance forming their walls by the action of osteoclasts. Occupying the channels are very dilated sinusoids, which present an almost angiomatous appearance in some areas. The sinusoids are lined by flattened endothelial cells in the early stages, and are usually rather empty in sections. This is probably due to the fact that most of the specimens were obtained from animals which had been "bled-out" during slaughter, and also that a great deal of blood oozes out of the sinusoids when the Distal Navicular ligament is severed during removal of the bone. Erythrocytes can, however, be observed near the lining of the sinusoids. Smith (1886), who studied the histology of Navicular disease in animals which had not been "bled," describes the extreme vascularity of these sinusoids.

In one case studied, there was a considerable accumulation of plasma cells around these sinusoids, indicating some degree of sub-acute or chronic inflammation. In the vast majority of the sections studied, however, there were only the usual isolated plasma cells and lymphocytes to be seen.

In the early stages of the disease, there is some proliferation of the fibroblasts of the connective tissue of the marrow cavities around the sinusoids, with the production of a fine connective tissue. This is sometimes slightly œdematous, and may show hæmorrhages into its substance. As the disease process advances, the connective tissue becomes more and more dense until it is quite fibrous in appearance. The small arteries and blood vessels in the connective tissue show considerable thickening of their walls. Proliferation of the endothelial cells lining the dilated sinusoids often occurs, as the disease continues, as if in response to some mild irritation, and some of the proliferated cells show degenerative changes and loss of staining power.

The sinusoids become dilated still further and further into the substance of the bone, with subsequent removal of bone tissue (in order to remove the pressure set up in the marrow spaces of the bone), and apparent rarefaction of the bone tissue on radiography. The connective tissue produced in place of the removed bone tissue, sometimes apparently contains endosteal tissue,

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and new woven bone may be laid down in its substance, often to be re-absorbed in turn by osteoclasis. Granules of hæmosiderin appear in the connective tissue of the marrow spaces and are taken up by histiocytes.

In some of the sinusoids thrombosis occurs, the thrombi later becoming organised. Sections of an advanced stage of the disease show several of the sinusoids completely obliterated by new fibroblasts, subsequent to the organisation of thrombi. The original outline of the walls of the sinusoid can still be distinguished, but the lumen is occupied by a mass of proliferating fibroblasts (Figure 1).

The dilation of the sinusoids continues into the sub-chondral marrow spaces of the tendinous surface and leads to osteoporosis of the sub-chondral bone tissue. In some cases, the weakening of the bony support leads to collapse of focal areas of the fibro-cartilage of the surface, in areas where tendon pressure occurs. The collapsed portion of the cartilage and its sub-chondral bone is partially resorbed by osteoclasis and may be incorporated into the remainder of the sub-chondral bony framework by deposition of new bone upon it by osteoblasts. The defect created by the collapse of the cartilage forms a cavity in the tendinous surface, which usually remains constant in shape and size until adhesion takes place or until further osteoclastic activity occasions the collapse of adjacent areas of the cartilage. Cavities may also be formed by the enlargement of the " punched-out " areas of erosion mentioned above.

The fibro-cartilage of the tendinous surface shows signs of retrogressive changes early in the disease process. The changes may be of one or more of three main types. There may be absolute disappearance of the cartilage cells from the whole depth of the fibro-cartilage, often associated with the " thinning " of the cartilage described earlier. The cells may become more scanty in number, but enlarged in size, and become intensely basophilic, appearing almost as if they were calcified. The other main change is that the fibro-cartilage shows changes in which degeneration of the superficial cells takes place while the deeper cells form themselves into groups (Figure 2). There may be definite vertical fibrillation of the matrix and erosion of the cartilage occurs with subsequent irregularities of the bursal surface of the fibro-cartilage.

The bursal surface of the tendon, in contact with the affected tendinous surface, soon shows signs of wear. There may be necrosis of its superficial zones, as described earlier, and often the superficial area is also torn and ragged. The superficial cells have disappeared and the deeper cells form th groups mentioned above. (Smith (1893) regarded these cells as cartilage cells derived from the tendinous surface fibro-cartilage by friction, but during the present study they have been seen in situations in the tendon, where they could not be assumed to have been derived from the tendinous surface by any stretch of the imagination. In the normal tendon the peritendonium of the bursal surface of the tendon, contains cartilage type cells, and it is not surprising that they react, as do most cartilage cells, to adverse changes. There does not appear to be any attempt at repair on the part of the tendon. The latter is relatively avascular, the vessels all being situated in the connective tissue on the aspect furthest away

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from the bursal surface. There is no attempt at revascularisation of the injured portion of the tendon from these blood vessels, and it would seem, therefore, that the vascular granulation tissue which forms the adhesion between the tendon and the tendinous surface of the bone, must be derived from the marrow spaces of the bone.

The granulation tissue is produced in the marrow spaces of the bone, where cavities have been established, possibly in response to the irritation produced by the exposure of the soft connective tissues to the traumatic influences suffered by the bursa. The granulation tissue eventually proliferates out of the cavity and comes into contact with the eroded surface of the tendon, with resultant adhesion of the two "raw" surfaces (Figure 3). The adhesion is, at first, extremely vascular and almost angiomatous in appearance, but later the central portion contracts and becomes rather fibrous. The peripheral portions of the adhesion remain vascular and granulation-like in appearance, probably due to slight movements of the adhesion, occasioned by the movements of the tendon, causing friction against the edges of the cavity in the bone.

The granulation tissue formed in the marrow spaces of the bone leads to definite changes there. The rapid growth of the granulation tissue leads to marked osteoclastic erosion of the bone tissue, with the subsequent formation of the large areas of rarefaction of the bone seen in advanced cases on radiography. The granulation tissue, being formed partly from the endosteum of the marrow spaces, also possesses osteoblastic potentialities and new bone is often formed within its substance, frequently to be re-absorbed by osteoclasis, as the granulation tissue proliferates. This absorption and deposition of bone leads to the formation of a mosaic appearance of the bone tissue surrounding the granulation tissue area.

Subsequent changes would appear to be dependent upon the degree of immobilisation effected by the adhesion and the work that the animal is called upon to perform. If the immobilisation is fairly complete, the stimulus to new granulation tissue formation will subside and the established granulation tissue will contract and become fibrous tissue probably with the deposition of new bone in its substance. With incomplete mobilisation, the continued irritation induced by movement leads to the production of more granulation tissue and further resorption of the bone tissue. The subsequent rarefaction of the bone causes it to become weakened and fracture may occur if there is any violent trauma.

The new bone formation on the upper edge of the bone may occur in the absence of any other change in the bone. Histologically, new bone formation appears to occur in three main ways:—

(*a*) Metaplasia of the fibrous tissue of the upper edge into woven bone;

(*b*) Deposition of new bone woven in the fibrous tissue by osteoblasts;

(*c*) Deposition of new woven or lamellar bone upon the calcified fibrocartilage of the upper edge of the bone, again by osteoblasts.

In some areas there are signs of an inflammatory change in the form of small areas of granulation tissue formation and small hæmorrhages into the tissues, but these are not invariably present. From the histological viewpoint,

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it would appear that the new bone may be produced in response to inflammatory changes in the soft tissues of the upper edge, or as a compensatory process subsequent to rarefaction of the central bone tissue.

Acknowledgment

The writer wishes to express his gratitude to the administrators of the Racecourse Totalisator Trust Fund, who have borne the expense of the larger work of which this study forms a part.

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STUDIES IN BOVINE MALIGNANT CATARRH

III.—The Effect of Storage and Temperature on the Viability of Virus

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THE work described in this series of articles (Piercy, 1952) was undertaken partly because it was thought that the incidence of malignant catarrh in Kenya is much higher than is commonly supposed. The similarity of the clinical symptoms to those of other diseases, such as East Coast fever, make an immediate diagnosis difficult at the commencement of an outbreak. Where an established history of the disease in a herd is lacking, the only certain method of diagnosing

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malignant catarrh is by the reproduction of the disease in susceptible bovines, although histopathological examinations of affected tissues are of considerable value in that characteristic accumulations of lymphoid cells in such diverse situations as bladder, adrenal gland, liver, œsophagus and brain are not typically found in other bovine diseases.

In an attempt to gain accurate information of the incidence of malignant catarrh in Kenya, it was hoped to examine as much material as possible from outbreaks simulating this disease, but in view of the difficulties of transport and communication inseparable from most colonial territories, which render the receipt of fresh specimens in under 24 hours unlikely, it was thought wise first to carry out a number of experiments designed to test the viability of the virus under different conditions of storage and temperature.

The fragility of malignant catarrh virus has been noted by several workers. Thus Götze (1930) was unable to transmit the disease with blood stored for 24 hours. Mettam (1923) found that refrigerated blood became inactive in 14 days. Daubney and Hudson (1936) and Scholefield and Bain (1941) found that live virus could still be demonstrated in material stored in 50 per cent glycerine for one week.

Materials and Methods

Virus Strains

(i) The " D " strain of bovine malignant catarrh (Piercy, 1952).

(ii) A rabbit adapted strain (Piercy, to be published).

Viability Tests

All tests for viability of virus in cattle were made by the intraglandular inoculation of susceptible bovines with 2.0 c.c. of a 20 per cent suspension of lymph gland.

Challenges

In cattle these consisted of the intraglandular inoculation of 2.0 c.c. of a 20 per cent suspension of known infective lymph gland. In rabbits the usual method was the intraperitoneal inoculation of 2.0 c.c. of a 30 per cent suspension of infective rabbit spleen.

Results

These are summarised in Table 1.

(i) *Room Temperature* (±20° C.)

Bovine 359, reacting to experimentally-induced malignant catarrh, died during the night of February 2, 1951. When opened the carcass was still faintly warm and it was estimated that death had occurred some six hours previously. Prescapular lymph gland was removed and divided into two portions, one being placed in the refrigerator at ±5° C., and the other on the bench at room temperature (±20° C.). After 24 hours' suspensions of the two portions of gland were made and inoculated to two steers. Bovine 1255, receiving refrigerated material, died of malignant catarrh after 24 days. Bovine 1753, given gland maintained at room temperature, did not react and when challenged was shown to be susceptible.

(ii) *Refrigerator Temperatures* (±5° C.)

Bovines 948 and 1255, given lymph gland which had been stored for 24 hours at ±5° C., and bovine 1254, given lymph gland which had been similarly stored for 29 hours, all died of malignant catarrh within 24 days.

Infective lymph gland from bovine 1973 was stored as (*a*) unpreserved whole gland and (*b*) macerated gland in equal parts of 50 per cent glycerine at ±5° C. The unpreserved gland was tested after four and seven days' storage by which time autolysis was advanced. The glycerinated gland was tested after 4, 7, 15 and 21 days' storage. Whereas the former was still infective after four but not after seven days, the glycerinated gland was not viable from the fourth day onwards.

Using brain from rabbit 6 (fourth intracerebral rabbit passage), a 25 per cent emulsion in nutrient broth was prepared and from this dilutions of 10^{-1}, 10^{-2} and 10^{-3} were made. These were stored at ±5° C. and tested for viability after one and seven days by the intracerebral inoculation of rabbits. After one day's storage virus was demonstrated to a titre of 10^{-1}. After seven days' storage neither the original 25 per cent emulsion nor any of the dilutions contained demonstrable virus.

Blood from rabbit 31 (seventh intravenous passage) was stored for 48 hours at ±5° C. in (1) citrate solution and (2) O.C.G.* preservative. When tested in rabbits by the intravenous route the citrated blood proved infective whilst the blood in O.C.G. was not viable.

Blood in citrate solution obtained from rabbit 36 (seventh intraperitoneal rabbit passage) was stored at ±5° C. and tested in rabbits using the intraperitoneal route after one, two, three, five and seven days. All the rabbits reacted and died of malignant catarrh.

(iii) *Freezing Point* (0° C.)

A portion of infective lymph gland taken from bovine 804 was placed in a refrigerator close to the ice-box. A further portion was inoculated immediately to bovine 1190 which died of malignant catarrh 23 days later. The stored gland was removed after 24 hours and found to be lightly frozen. It was thawed out and inoculated to bovine 342 which failed to react. When challenged this animal proved to be susceptible.

(iv) *" Deep-freeze " Temperatures* (—20° C.)

Infective lymph glands removed from animals reacting to malignant catarrh were stored in a " deep-freeze " refrigerator at about —20° C. for periods of up to nine days. Bovine 60 receiving gland stored thus for one day died of malignant catarrh after 31 days. Bovine 265, given gland stored for 48 hours, did not react and was later shown to be fully susceptible. Bovine 773, inoculated with gland stored for three days, appeared to go through a mild reaction on the 23rd day characterised by a brief temperature reaction reaching 104.4° C. When challenged, however, it reacted after an extended incubation period of 50 days

* Oxy-carbol-glycerine.

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and died. Bovines 649 and 354, given gland stored for five and nine days respectively, failed to react and were subsequently shown to be susceptible. The original viability of all those glands which failed to cause reactions after storage were checked by the inoculation of fresh material into a number of bovines, all of which reacted and died.

(v) *Lyophilisation*

Lymph gland removed from bovine 60 on the seventh day of reaction to experimentally-induced malignant catarrh was ground up with equal quantities of sterile sand and saline. The thick suspension was introduced into a number of Edwards* freeze-drier tubes in 1.0 c.c. amounts, lyophilised and sealed *in vacuo*. The viability of the original material was checked by the inoculation of bovine 343 which died of malignant catarrh 27 days later. After ten weeks' storage at —20° C., the material in one of the tubes was resuspended in saline and given to bovine 1224. No reaction occurred. When challenged this animal proved to be immune. Since it was not clear whether the resistance to challenge represented an immunity engendered by the inoculation of dried virus without visible reaction, infective lymph gland from bovine 649 was similarly treated and stored at —20° C. Its original viability was proved by the inoculation of fresh gland to bovine 948 which died of malignant catarrh after 24 days. After 15 days' storage, the dried gland was resuspended and given to bovine 803 which did not react and was later proved to be susceptible. It seems evident, therefore, that the animal, a Boran steer, which resisted challenge after inoculation with lyophilised gland stored for ten weeks, had acquired immunity prior to purchase or represented a rare case of natural resistance. Spleen from rabbit 39 (seventh intraperitoneal passage) was macerated in nutrient broth and lyophilised. After twelve days' storage at —20° C., the spleen was reconstituted to its original volume and given to rabbit 47 by intraperitoneal inoculation. No reaction occurred.

(vi) "*Shell-freezing*" *and Storing at*—60° C.

A spleen emulsion from rabbit 113 (tenth intraperitoneal rabbit passage) was prepared and sealed in ampoules. The ampoules were "shell frozen" in dry ice and alcohol and stored at —60° C. After twelve days one ampoule was removed, the spleen reconstituted to its original volume and given to rabbit 118 by intraperitoneal inoculation. No reaction occurred.

(vii) *Desiccation*

Infective lymph gland ex bovine 2212 was macerated in nutrient broth, centrifuged and the supernate discarded. The deposit was placed in an ordinary desiccator containing phosphorus pentoxide which was then evacuated and placed in a refrigerator room at ±5° C. for one month. The dried material was then resuspended to its original volume and inoculated to bovine 2565. This animal did not react and was later shown to be susceptible.

* W. Edwards & Co. (London), Ltd.

TABLE 1

Effect of storage and temperature on the virus of bovine malignant catarrh.

Storage Temp.	Period	Material	Animal	Result	Challenge
±20° C.	24 hours	Fresh gland ex bovine 359	Bovine 1753	S	Susceptible
	Control	„ „	1255	D(24)	—
±5° C.	24 hours	„ 649	948	D(24)	—
	24 „	„ „	1255	D(24)	—
	29 „	„ 813	1254	D(23)	—
	0 days	„ 1973	1894	D(22)	—
	4 „	„ „	2212	D(27)	—
	7 „	„ „	2327	S	Susceptible
	4 „	Glycerinated gland ex bovine 1973	2195	S	„
	7 „	„ „	2328	S	„
	15 „	„ „	1960	S	„
	21 „	„ „	2310	S	„
	24 hours	25% brain emulsion ex rabbit 6	Rabbit 15	D(19)	—
	24 „	„ „ 10^{-1}	16	D(47)	—
	24 „	„ „ 10^{-2}	17	S	Susceptible
	24 „	„ „ 10^{-3}	18	S	„
	7 days	„ „	19	S	„
	7 „	„ „ 10^{-1}	20	S	„
	7 „	„ „ 10^{-2}	21	S	„
	7 „	„ „ 10^{-3}	22	S	„
	2 „	Blood in citrate ex rabbit 31	40	D(12)	—
	2 „	Blood in O.C.G. ex rabbit 31	41	S	Susceptible
	1 „	Blood in citrate ex rabbit 36	43	D(25)	—
	2 „	„ „	40	D(12)	—
	3 „	„ „	44	D(15)	—
	5 „	„ „	45	D(19)	—
	7 „	„ „	46	D(11)*	—
	1 month	Desiccated gland ex bovine 2212	Bovine 2565	S	Susceptible
0° C.	2 days	Fresh gland ex bovine 804	342	S	„
	Control	„ „	1190	D(23)	—
—20° C.	1 day	„ 9153	60	D(31)	—
	2 days	„ 804	265	S	Susceptible
	Control	„ „	256	D(24)	—
	3 days	„ 60	773	Mild reac. recovered	Susceptible; inc. period 50 days
	Control	„ „	352	D(25)	—
	5 days	„ 773	649	S	Susceptible
	Control	„ „	798	D(18)	—
	9 days	„ 60	354	S	Susceptible
	Control	„ „	352	D(25)	—
	10 weeks	Lyophilised gland ex bovine 60	1224	S	Immune
	Control	Fresh gland ex bovine 60	343	D(27)	—
	15 days	Lyophilised gland ex bovine 649	803	S	Susceptible
	Control	Fresh gland ex bovine 649	948	D(25)	—
	12 days	Lyophilised spleen ex rabbit 39	Rabbit 47	S	Susceptible
—60° C.	12 days	Shell-frozen spleen ex rabbit 113	Rabbit 118	S	

* Malignant catarrh confirmed by sub-inoculation. D(23) = died of malignant catarrh after 23 days. S = survived.

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Discussion

The evidence presented in the table emphasises the extreme fragility of the malignant catarrh virus. The longest period of storage after which viable virus could be demonstrated was seven days (citrated rabbit blood maintained at ±5° C.). Lyophilisation and subsequent storage at —20° C. proved ineffective and no virus was demonstrable after a period of only 15 days. Indeed, there was evidence that the actual process of freezing is injurious to the organism since inactivation occurred in fresh gland after two days at 0° C. or —20° C. whereas gland kept for four days at ±5° C. was still infective. Furthermore, citrated blood, which contains considerably less virus than lymph gland, was still capable of transmitting infection after seven days' storage at ±5° C.

It was thought that simple drying without freezing might preserve the virus but this again proved not to be the case.

Towards the end of these experiments supplies of dry ice became available and the effect of "shell-freezing" in dry ice and alcohol with subsequent storage at —60° C. was investigated, but again with disappointing results.

It appears then that the virus of bovine malignant catarrh is incapable of preservation by the usual methods used with success for other viruses. It would seem that the only remaining hope is the evolution of a method of storage by chemical means. Until preservation for reasonable periods can be achieved this disease remains a most difficult one to investigate since the only way the virus can be maintained is by serial passage in cattle, a costly procedure, or in rabbits with the ever-attendant danger of losing the strain through intercurrent infections such as pasteurellosis and coccidiosis.

The experiments reported in this article largely confirm the findings of other workers. It is of interest to note, however, that Götze (1930) was unable to transmit infection with blood stored for only 24 hours, and conversely Daubney and Hudson's (1936) observation that live virus was still present in glycerinated material after one week at ±5° C. was not confirmed in the present work.

One important point emerges from these experiments. There is very little hope of obtaining a positive diagnosis of malignant catarrh or of undertaking a survey of incidence by biological means unless fresh material is received in less than 24 hours after the death of the animal. This is frequently impossible and in tropical countries where temperatures are high and communications inadequate, reliance must be placed on the histological examination of preserved organs such as lymph gland, liver, kidney, brain and adrenal gland. Extensive histopathological studies of both bovine and rabbit infected tissues have been made at this institute with the result that a diagnosis of malignant catarrh can now be made with confidence by the examination of morbid specimens (Plowright, 1952).

Summary

(1) Attempts have been made to preserve the virus of bovine malignant catarrh by storage at temperatures ranging from ±5° C. to —60° C., and by desiccation, lyophilisation and "shell-freezing" in dry ice and alcohol.

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(2) None of these methods was able to prolong the viability of virus for more than a few days. The best result was obtained with citrated blood which was still infective after seven days' storage at ±5° C.

(3) The results indicate that the actual process of freezing, whether induced by dry ice and alcohol, lyophilisation or "deep-freeze" machines, is injurious to the virus.

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MORTALITY RATES AND DISEASE INCIDENCE IN CALVES IN RELATION TO FEEDING, MANAGEMENT AND OTHER ENVIRONMENTAL FACTORS

PART IV.

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(This work has been approved for the award of the degree of Ph.D in the Faculty of Science of the University of London.)

IV. Information relating to the dam and parturition

1. *Nutrition during pregnancy.*

With a view to assessing the possible effects of the nutrition of in-calf cows and heifers on the mortality rates of their offspring, an attempt has been made to allot numerical values to the "plane of nutrition" in the dairy herds.

The form used for this purpose is reproduced in Table 25.

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TABLE 25

Scheme used in marking herds for nutritional plane.

Item of diet		Points	Summer	Winter
Starch foods	High	5 or 6		
(judged by condition)	Medium	3 or 4		
	Low	1 or 2		
Protein	High	5 or 6		
	Medium	3 or 4		
	Low	1 or 2		
Carotene and/or vitamin A ...	High	5 or 6		
	Medium	3 or 4		
	Low	1 or 2		
Variety of diet	Good mixed	5 or 6		
	Medium	3 or 4		
	Restricted	1 or 2		

Points were allotted for the various items of the diet for summer and winter on this scale with a maximum of 48. The general standard was good and the points given ranged from a maximum of 46 to a minimum of 25.

The details of this assessment with the dairy herds arranged in order of marking are given in Table 26 together with the heifer calf mortality rates to one month and to six months of age for the three-year period.

The herds may be arbitrarily divided into two groups based on the nutritional standards: Group I, 41 points and over (18 herds), and Group II, 40 points and less (17 herds).

It will be seen that of eight herds with unsatisfactory calf mortality rates (BIII, RIII, AI, LIII, LoIII, RII, AVI and EII) three are in Group I and five in Group II. Among the latter are the two herds with the worst records for calf mortality (AVI and EII) and their high rates have been consistent during the three years. Two other herds (BIV and RI) with rates rather above the average are also in Group II. In herd LV which has the lowest standard of nutrition, the calves were generally in poor condition in spite of low loss and this was probably due to the nutritional level.

Of the 25 herds with satisfactory mortality records, 15 are in Group I and 10 in Group II. Thus generally, a majority of the herds with good calf mortality records were of a high standard of nutrition and a majority of those with unsatisfactory records were of a lower standard.

The exceptions show that this factor is only one of many which exert an influence on the death rates of calves. Its effect is probably most important with regard to the intake of adequate green feed during the winter months. Eighteen of the 35 herds have received only half the maximum points or less

TABLE 26

Dairy herds: nutritional assessment and heifer calf mortality rates to one month and to six months.

Herd	Nutrition: Starch S	Starch W	Protein S	Protein W	Carotene vitamin A S	Carotene vitamin A W	Variety S	Variety W	Total	Mortality 3 years: To 1 month old	To 6 months old
EIV	6	4	6	6	6	6	6	6	46	3.1	5.8
LoI	6	6	6	6	6	6	6	4	46	3.8	3.8
LoII	6	6	6	6	6	6	6	4	46	7.7	7.7
LI	6	4	6	6	6	4	6	6	44	2.4	3.8
BaIII	6	4	6	6	6	4	6	6	44	nil	1.4
NVI	6	4	6	6	6	4	6	6	44	6.3	6.9
BIII	6	6	6	6	6	4	6	4	44	11.8	16.5
RIII	6	6	6	6	6	4	6	4	44	7.8	10.8
AI	6	4	6	4	6	5	6	6	43	8.9	13.3
CVII	6	5	6	5	6	4	6	4	42	nil	4.4
NI	6	4	6	6	6	4	6	4	42	1.6	3.2
BII	6	4	6	6	6	4	6	4	42	1.8	3.6
AII	6	4	6	4	6	4	6	5	41	2.6	3.4
AIV	6	4	6	4	6	6	5	4	41	4.3	6.0
EV	6	4	6	4	6	4	6	5	41	2.1	5.2
CIII	6	6	6	6	6	3	4	4	41	1.6	2.4
NII	6	4	6	4	6	3	6	6	41	6.4	7.4
BI	6	4	6	6	6	3	6	4	41	nil	nil
LIII	6	6	4	4	6	4	6	4	40	7.2	16.2
LoIII	6	5	6	5	6	2	6	4	40	11.5	13.1
RII	6	4	6	6	6	4	4	4	40	8.7	13.0
LoIV	6	6	6	4	6	3	4	4	39	2.3	6.8
BV	6	4	6	6	6	3	4	4	39	1.6	1.6
CI	6	6	6	4	6	2	4	4	38	2.0	2.0
NIV	6	4	6	4	6	2	6	4	38	3.8	5.1
BIV	6	4	6	6	6	2	6	2	38	5.4	8.9
RI	6	4	6	4	6	2	6	4	38	7.7	9.9
CVI	6	4	6	4	6	2	4	4	36	nil	5.3
LIV	6	4	5	4	4	2	6	4	35	4.0	4.0
AVI	6	4	4	4	6	3	4	3	34	20.1	22.4
EI	4	4	5	5	4	2	6	4	34	6.4	7.7
CV	6	4	6	4	4	2	4	4	34	3.1	3.1
BaI	6	4	4	4	4	0	6	4	32	5.8	5.8
EII	4	4	4	2	4	2	4	4	28	21.1	24.3
LV	4	4	4	2	4	1	4	2	25	1.0	4.8
									Average mortalities	6.2	8.3

S = Summer. W = Winter.

for this item of the diet and four of them are herds with high mortality rates, two with rates a little over the average and one in which calves have been in poor condition. Only three of the herds in Scotland received low points for this item and two of them have very bad sickness and mortality records. The provision of sufficient green foodstuff in winter for in-calf animals is probably of more importance in Scotland where there are more calvings in the spring than in the autumn. In England and Wales autumn calvings predominate.

A study of this subject, comparing the mortality of spring calves born of dams wintered out, fed adequate greenstuff indoors and stall-fed in the ordinary way respectively, has been made in Scotland by Payne (private communication, 1948). It has shown the advantages of out-wintering and the feeding of grass-silage to housed cattle in this respect.

2. *Non-lactating periods and milk yields.*

Distribution of extent of non-lactating period.

Of 437 calves which died in the dairy herds during the three-year period, 122 were first calves and 315 calves of cows. The non-lactating periods before calving are known in 268 cases. Although they are distributed among 30 herds, over half are in six herds which have experienced heavy calf losses.

A random sample of cows whose calves survived, consisting of corresponding numbers from each herd, has been taken for comparison. The dry periods of the cows in the two groups are shown as frequency distributions in Table 27.

TABLE 27

Comparison of extent of dry period in cows whose calves died and survived.

Extent of dry period in days	Dry periods of Cows whose calves died		Cows whose calves survived	
	No.	Per cent	No.	Per cent
0— 19	1	0.4	4	1.5
20— 39	18	6.7	19	7.1
40— 59	51	19.0	42	15.7
60— 79	57	21.2	43	16.0
80— 99	35	13.1	62	23.1
100—119	38	14.2	36	13.4
120—139	23	8.6	16	6.0
140 and	45	16.8	46	17.2
Total	268	100.0	268	100.0

This comparison of the dry periods of cows whose calves died with equal numbers from the same herds whose calves survived shows no striking differences. The commonest length of the former is 60 to 79 days and of the latter 80 to 99 days but otherwise the two distributions are similar.

The high proportion of dry periods of 140 days and over in both groups is considerably weighted by one herd (EII) which has suffered heavy calf losses and in which the mean dry period is 162 days. The omission of this herd would

reduce the proportion of dry periods of 140 days and over to about 10 per cent, but otherwise the figures are not materially affected.

A frequency distribution of dry periods for 33,060 cows given in the Report of the Milk Marketing Board for the year ending September 30, 1947, is reproduced, for comparison with the foregoing, in Table 28.

TABLE 28

Frequency distribution of dry periods for 33,060 cows compiled by the Milk Marketing Board.

Dry period days		Proportion per cent		Dry period days		Proportion per cent	
0— 9	2.4	6.3		80—89	8.2	15.2	
10—19	3.9			90—99	7.0		
20—29	5.9	14.2		100—109	5.7	9.9	
30—39	8.3			110—119	4.2		
40—49	10.5	22.0		120—129	3.1	5.4	
50—59	11.5			130—139	2.3		
60—69	10.7	20.2		140—149	1.7	6.8	
70—79	9.5			150 and over	5.1		

Here the typical length of dry period is 40 to 70 days and the average 73 days.

It appears that in the herds taking part in the present survey, dry periods are in general longer than is commonly the case.

TABLE 29

Deviations from the herd mean of dry periods of cows whose calves died and survived.

		Cows whose calves died	Cows whose calves survived	
Mean and above		*44.3*		*46.2*
↑	Over 100 days	3.7	3.7	
	81—100 „	1.1	2.2	
	61— 80 „	2.6	2.2	
	41— 60 „	7.8	6.7	
	21— 40 „	9.7	13.8	
	0— 20 „	19.4	17.6	
Herd mean				Herd mean
↓	1— 20 days	20.6	23.9	
	21— 40 „	18.0	15.0	
	41— 60 „	11.2	8.6	
	61— 80 „	4.5	3.4	
	81—100 „	0.7	2.2	
	Over 100 „	0.7	0.7	
Below mean		*55.7*		*53.8*

The distributions in Table 29 are expressed as percentages.

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Comparison with herd averages.

The mean dry periods for most herds in the survey have been obtained from the Milk Marketing Board and the Scottish Milk Records Association, for the years concerned. The deviations from the mean dry period in the different herds for the two groups of cows, viz., those whose calves died and the random sample whose calves survived, have been totalled and the results are given in the following table as percentage frequency distributions above and below the herd averages.

These figures show only slight differences between the two groups. In each group more than half the dry periods are below the herd means and there is less than 2 per cent difference between the proportions above and below in the present two groups.

It is clear from the foregoing that significant differences between the dry periods of cows whose calves died and survived are not demonstrable in the series of dairy herds.

Comparison of herds with high and low calf mortality.

A striking feature is the great variation in the dry periods, irrespective of the fate of the calves, in those herds which experienced heavy calf mortality. In these herds dry periods have varied from a minimum of 20 to 40 days up to 150 to 200 days and in extreme cases much more. This is in marked contrast with the comparative uniformity of dry periods in the herds with low calf mortality records. The following (Table 30) gives frequency distributions of the dry periods of approximately 200 cows in the six herds with the highest calf losses compared with an equal number from six herds with small losses. The numbers from each herd are proportional to the size and include the dams of both casualties and survivors. The samples are taken at random.

TABLE 30

Comparison of dry periods of cows in six herds with high calf mortality and in six with low rates of mortality.

Dry period days	Percentage distributions "Good" herds	"Bad" herds
0— 19	0.5	—
20— 39	5·7	4·5
40— 59	25.4	11.6
60— 79	32.1	17.6
80— 99	15.0	19.6
100—119	7.3	16.1
120—139	6.7	10.5
140 and over	7.3	20.1
	1.00.0	100.0

In the herds with low calf mortality records the distribution of dry periods is orthodox. The typical length is 60 to 80 days and 72.5 per cent are between 40 and 100 days. The proportion of long dry periods is small. The position in

the herds with heavy calf losses is in strong contrast. There is a wide "spread" and a large proportion of dry periods which are very long.

This difference in the distribution of dry periods appears to be an expression of the types of management in the two groups of herds.

The mean dry periods in the six "good" herds ranged from 48 to 84 days and in the six "bad" herds from 62 to 162 days. They are on the average 30 to 40 days longer in the latter. This indicates that provided a comparatively short minimum dry period is ensured there appears to be no adverse effect on the mortality rates of calves.

Milk Yields

These cannot be directly compared or aggregated in a frequency distribution owing to difference of breed, quality of cattle and methods of management.

The yields of 192 cows whose calves died and for which data are available have been compared with a random sample whose calves survived in respect of their relationship to the herd averages with the following result.

TABLE 31

Comparison of yields of cows whose calves died and survived with herd averages.

	Percentage of yields	
	Above herd average	Below herd average
Cows whose calves died ...	54	46
Cows whose calves survived ...	47	53

These results are rather more pronounced than the figures for dry periods and indicate that more than half the cows whose calves died had yields above the average compared with less than half those whose calves survived.

Variations in milk yield are again a marked feature of the herds with bad calf mortality records, both among cows whose calves died and others. In the herds with low calf losses the yields show much greater variations than in the case of dry periods but they are not so marked as in the "bad" herds. An indication of the variations encountered is given in the following Tables (32 and 33) which show lowest and highest yields recorded among cows whose calves died and survived in the "bad" herds, and random samples of maximum and minimum yields in the "good" herds. The same sets of six herds each have been used as were employed for the dry period data above.

TABLE 32

Herds with high calf mortality: maximum and minimum yields—gallons.

Herd average	Cows whose calves died	Cows whose calves survived
886	634—1,689	412—1,201
488	261— 695	180— 791
996	636—1,324	600—1,672
702	303— 981	248— 982
800	601—1,118	556—1,103
996	136—1,065	410—1,200

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TABLE 33

Herds with low calf mortality: maximum and minimum yields—gallons.

Herd average	Cows taken at random and including the dams of casualties and survivors
794	571—1,122
797	685—1,766
894	610—1,172
1,327	812—1,735
700	409—1,136
1,004	682—1,237

3. *The incidence of multiple births.*

During the three years of the survey in all herds 9,123 pregnancies were recorded resulting in 8,720 live calves and 607 abortions and stillbirths. The pregnancies and multiple births recorded are shown in Table 34.

TABLE 34

Pregnancies and multiple births during the years 1946 to 1948 inclusive.

	Pregnancies	Sets of Triplets	Pairs of twins
1946	3,019	1	64
1947	2,962	2	55
1948	3,142	—	79
1946-48	9,123	3	198

The incidence of triple births was therefore 0.329 and of twin births 21.7 per thousand pregnancies.

An analysis of the multiple births is given in the next table.

TABLE 35

Analysis of multiple births.

	Year 1946	1947	1948	3 yrs. 1946-48	
Triple births:					
MMM. All dead	1	1	—	2	3 sets triplets
MFF. All alive	—	1	—	1	
Twin births:					
MM. Both alive	13	7	15	35	50 pairs *MM* twins
One alive, one dead	3	1	2	6	
Both dead ...	3	3	3	9	
FF. Both alive	12	9	17	38	50 pairs *FF* twins
One alive, one dead	2	1	4	7	
Both dead	1	—	4	5	
MF. Both alive	23	27	22	72	94 pairs *MF* twins
M alive, *F* dead ...	—	1	—	1	
F alive, *M* dead ...	4	2	2	8	
Both dead	1	4	8	13	
SNR. Both dead	2	—	1	3	3 pairs *SNR*
M, SNR. M alive, *SNR* dead	—	—	1	1	1 pr. *M, SNR*
	Tr. 1	Tr. 2	Tr. 0	Tr. 3	
	Tw.64	Tw. 55	Tw. 79	Tw.198	

Note: M=male; *F*=female; sets of twins and triplets are denoted *MM, MF, MMM,* etc. *SNR*=sex not recorded. *Tr.*=triple birth. *Tw.*=twin birth.

The number of calves and aborted fœtuses resulting from these multiple births was 405. Their sexes and the numbers born alive and dead are shown in the next table.

TABLE 36

Calves and aborted fœtuses resulting from mutiple births : sexes and whether born alive or dead.

	Born alive	Born dead	Totals	Percentages of the sexes
Males	151	51	202	49.9
Females	165	31	196	48.4
Sex not recorded	—	7	7	1.7
Totals	316	89	405	—
Percentages alive and dead ...	78	22	—	100.0

The proportions of twin births of the three sex arrangements were as follows :—

Male—female ...	47.50 per cent
Male—male ...	25.25 per cent
Female—female	25.25 per cent
Sex not recorded	2.00 per cent

There thus appears to be a tendency for the sexes to be numerically equalised by the occurrence of male—female, male—male, and female—female sets of twins in the ratio 2 : 1 : 1. As the majority of female twins to males are freemartins and few bull calves are required in dairy herds, only about one quarter of the twins born are of any economic value.

Of the multiple births here recorded only 27 twin births are first calvings or 13.4 per cent of the total multiple births. First calves form 30.4 per cent of the total births indicating that the production of more than one fœtus at a birth is about three times as frequent in cows as in first calving heifers. The exact figures are given in Table 37.

TABLE 37

Comparison of the incidence of multiple births in cows and in first calving heifers.

	Number of Pregnancies	Multiple births	Incidence per cent
Heifers ...	2,814	27	0.96
Cows ...	6,309	174	2.76

Of the twin births in first calving heifers (27), 17 were opposite sex pairs, five male and five female pairs, a ratio of over 3 : 1 : 1 but maintaining numerical equality of the sexes. Of the 54 calves resulting from these twin first calvings, 16 were born dead, or 30 per cent, compared with the general incidence of stillbirths and abortions in first calves as a whole of 8.4 per cent.

(To be concluded)

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ABSTRACT

SOME NOTES ON THE REINDEER, by R. H. A. Merlen, Anatomy Department, Royal Veterinary College.

IN an effort to raise as many meat-producing animals as possible on hill and rough grazing, an attempt is being made at the present time to re-introduce the reindeer into parts of Scotland, and in view of this interesting experiment it is worth while considering briefly some of the points connected with reindeer ranching which obtain in those countries where the animal is indigenous.

The current number of "Sotzialisticheski Zhivotnovodstvo" (December, 1952) carries two articles on reindeer farming, both of which are concerned with the government ranch, "Naryan-ti," situated some 400 miles north-east of Archangel, and while both articles state very plainly that the situation there is far from satisfactory they give a clear picture of the difficulties attending reindeer ranching on the Arctic tundra.

The reindeer are kept in the open all the year round and subsist entirely on the naturally growing flora: they receive no supplementary rations of any kind. During the spring, autumn and short summer (end of July to the beginning of September) the grazing which is composed of green grass and other plants, is adequate and even good. The summer, however, is not the best season for these animals: at this period the insect pests are exceedingly numerous on the pastures and the herds are particularly subject to the attacks of the gad- and nasal flies. At this time foot rot makes its appearance and may assume epizootic proportions. Necrobacillosis is also a disease of the summer months although its incidence may to some extent be controlled by the provision of tents in which the beasts may take refuge from the heat ("Veterinaria," December, 1951).

It is, of course, the winter, a season lasting some 110 days, which is the testing time on the ranch. The problem of winter keep dominates every other consideration. This winter keep is provided by a lichen growing on the tundra and the manipulation of this crop, which only grows at the rate of about three millimetres a year, requires the greatest care and experience—if overgrazed it recedes and the pasture is no longer of any value, if undergrazed it bolts and again the grazing is useless: continual light grazing alone will keep it at its best and this was the type of treatment it received from the herds of the aboriginal nomads who were at liberty to wander over the whole of the region. When husbandry is that of the "ranch" system (in this case the herd was 60,000 strong), the grazing problems are accentuated. The exigencies of the situation have led reindeer farmers to adopt the following procedure: the main herd is broken up into a number of smaller groups each comprising about 500 head and each group is attended by four or five herdsmen and their dogs. The available winter grazing, which has been carefully preserved, is then divided into a number of parallel strips (in the case in question the average width of the strip was about five kilometres and the length about 35-40 kilometres). A strip is assigned to each herd and it is grazed in rotation. This system has the advantage of avoiding overcrowding on any given piece of pasture with the resultant

destruction of the grazing by the animals' feet: it also allows a selected herd—a breeding herd for example—to receive preferential treatment, for if the number of animals in their herd is kept small it will obviously do better on it's strip than will those with a larger number of beasts. This method gives an average of six acres per head of winter pasture for the breeding herd and three and three-quarters for the others. But even with the best care "winter atrophy" is observed annually in all the animals.

Salt is a vital necessity for the beasts in winter and it is estimated that each animal requires about 5 grams a day to keep it in health: rock salt is loaded on to sledges and drawn out to the pastures and as the bottom of these sledges are some three feet from the ground they make excellent mangers and the salt is not lost in the snow.

The great hazard of the winter season is attack by packs of wolves which commit serious ravages on the herds whenever opportunity offers.

There would appear to be much room for improvement in reindeer farming in the north of Russia, there is a failure to work out plans of winter grazing, other pastures are overgrazed, the herdsmen are slack, the dogs are poor in quality and lack training: but in particular breeding is apparently grossly mismanaged. The system adopted at present is to castrate only the larger and stronger stags—presumably because they are inclined to be savage—and to leave all the others, the scrub bulls, entire to run with the does and cover them promiscously. The result of this technique has been to produce a great increase in the number of poor, undersized and sickly calves, many of which do not attain maturity, and an increase in sterility among the does accompanied also by an increase in dystokia. The breeding schemes which are suggested by the experts lay down, among other things, that the larger stags should be used for stud, that four or five should run with 100-150 does and that an interchange of stud stags should be undertaken among the various ranches. By using these methods it is claimed that sterility among the does has been reduced to about 2 per cent, and the dead-weight of calves has increased from three kilos to 30.

The question as to whether reindeer are susceptible to foot and mouth disease has been a subject for discussion for a considerable time: Gruner ("Prakticheskaya Veterinaria," May, 1929) reviews the subject at some length and comes to the conclusion that in this animal the disease runs a very mild course but that it may be complicated by that form of foot-rot which is very prevalent among reindeer in which case septicæmia and death may result. It may be that this condition of the feet is in itself a form of foot and mouth disease.

It is interesting to note that chloral hydrate given intravenously in doses of approximately 0.3 grams per kilogramme body-weight is a good general anæsthetic for the reindeer ("Veterinaria," December, 1929). This dose has to be reduced in the winter to 0.06 grams and this fact gives a vivid impression of how "winter atrophy" lowers the animal's resistance.

With reference to the occurrence of necro-bacillosis in reindeer, Popov (1952) points out that the cause of "head sickness" may be ascribed to the same origin. This condition is typified in mild cases by the appearance of

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necrotic ulcers in the frontal region accompanied by swelling of the frontal bones and shedding of the horns. In fatal cases the infection spreads to the brain and meninges. The condition is liable to occur during the late autumn at the tme when outbreaks of necro-bacillosis of the feet are prevalent in " head sickness." The bacilli gain entrance to the tissues through wounds in the frontal region which are brought about by the stags fighting during the rutting season. " Head sickness " is comparatively uncommon on the shores of the Sea of Okhotsk and the eastern Siberian Sea.

MEMOIR

JAMES THOMAS GRIFFITHS EDWARDS, D.Sc., M.R.C.V.S.

James Thomas Griffiths Edwards died on Thursday evening, November 6, 1952. His end was peaceful, for he fell asleep whilst on a bus journey from Camden Town to his lodgings in Islington. He had been present at a meeting of the Central Veterinary Society, where his presence had been noted with acclamation, for his fellow members took his presence as a sign of his recovery from the serious illness, pneumonia, which had laid him low ever since the opening of the winter session. Such was the passing of one who had earned a place amongst our immortals, for by his life and work he had achieved renown and brought honour to his profession and gained the respect and love of his fellows.

Edwards was a Welshman and proud of his true blood. He was born at Mount Pleasant, Kidwelly, Carmarthenshire, on November 5, 1889, and he was the eldest son of Samuel and Mary Anne Edwards. When he was nine years old the family moved from Kidwelly to Pembrey. He went to school for the first time when he was only two-and-half years old, at the Hillfields Infant School Kidwelly, which was in charge of a Mrs. Harris. His next move was to the Castle Boys' School, which was then conducted by a Mr. and Mrs. Jones. In 1902 he was due to leave this elementary school. A County Secondary School had been opened at Llanelly and six scholarships were offered to the elementary school students, being designated on the results of open competition by examination. He entered and gained third place on the list.

This secondary school was seven miles from his home and at that time there was no public road transport so he had to make the journey by train. He had to get up early in order to catch the train at Bury Port. The train arrived at Llanelly just before 9 o'clock. At each end of the rail journey he had to walk approximately one mile. Like most country boys he had chores to do on the farm before he could leave for the station. His was to help with the milking. He carried his lunch in his school satchel and he was allowed 1d. per day as pocket money. By modern standards this would appear to be

miserably inadequate but he told me that it was sufficient to provide him with a snack in the late afternoon before catching the 5.20 p.m. train from Llanelly.

He often spoke of the debt he owed to Llanelly School, for under Wm. Lewis, the headmaster, a strict and austere man much feared by the boys, the school was renowned for its teaching, its discipline and high moral tone. Apparently he was not greatly interested in games. Probably this was because he lived at a distance and all his spare time was occupied in his work tasks at home. Sunday was devoted largely to religious activity, Sunday School and attending the service at Bury Port Baptist Chapel.

In due course, when he was in the fifth form, he entered for the Senior Examination of the Central Welsh Board. He passed, and headed the list of his form. He gained Distinction in English Language and Literature, History, Latin and French, but only Pass marks in Chemistry, Physics and Mathematics. When he was in the sixth form he entered for the Honours Certificate of the Welsh Board. Just at this time the headmaster, Mr. Lewis, decided as an experiment to concentrate on science subjects rather than on the arts, as had previously been the custom. Edwards was at that time more attracted to the arts than to science and he was not pleased with the new idea, for in his own words: "He was no good at science." Difficulties were only made to be overcome and by assiduous application to the studies for which he really had no heart he managed to satisfy his examiners. His aversion to science was not his only trouble. He had been seriously ill with pneumonia and the examination came just at the end of his period of convalescence. Now this Welsh Examination did not exempt one from the Matriculation examination of London University. Work for the latter examination meant a greater effort. He sat for the examination at the local centre in Cardiff and he was one of the few from his school who were successful.

About this time he had a discussion with the Science Master, Mr. Foster, who enquired as to Edwards' plans for his future career. He told Mr. Foster that his mind turned towards a medical career, but Foster warned him that the assistant masters at the school were better off than doctors' assistants and that the reward was not worth while unless one had the capital to buy a practice and become a principal. Mr. Foster suggested that he should become a Veterinary Surgeon, arguing that they were much better off than the doctors, and, moreover, they enjoyed a better type of life. Edwards also told me that about this time Mr. Campbell Hill talked to the boys at the school about a Veterinary Surgeon's work and, although at that time he did not know Mr. Hill, the latter's talk tilted the scales and made him think seriously about the profession. He went to see Mr. Hill and asked for further information. Mr. Hill received him with great kindness and courtesy and so impressed the boy that the latter decided there and then on a Veterinary career.

He wrote to the various veterinary colleges for their prospectuses. He was attracted to the London school because of the newly instituted University degree, and he entered the Camden School as a student in October, 1907. He had never been far from home and he did not know anyone in London, so before departing

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on the great adventure he was advised to write to the Pastor at the Castle Street Welsh Chapel, near Oxford Street, to enquire if that worthy man could help him to get suitable lodgings. One of the Pastor's flock was a milkman in King Street, Camden Town, and he found Edwards accommodation with a family in College Place just near the College.

He settled in his lodgings in time to report as requested at the College at 9 a.m. on opening day. The prospectus also said that students must report to the Dean, so Edwards enquired of the commissionaire at the gate where the Dean was to be found. He was directed to Sir John M'Fadyean's laboratory. He knocked on the door and told a laboratory attendant that he wished to see the Dean. In a short time he was admitted to the presence of the great man, who enquired as to his business. He told Sir John that he was a new student and was reporting to him as instructed in the prospectus. Sir John received him kindly and personally conducted him over the quadrangle to the Secretary's office and introduced him to Mr. Powis.

Sir John little knew that by his kindness and courtesy to an unknown boy from the hills of Wales he was planting the seed of a respect and devotion which, in spite of the many trials of fate which were to beset that boy in his later life, was to grow and flourish and last until death. Let Edwards tell of his impressions in his own words:

"The quiet dignity of this man, of lithe figure, well dressed and groomed as he was then, who just dropped his work and conversation with his assistants and accompanied me, a young Welshman up from the country, to Mr. Powis' office, speaking to me so kindly and solving my little difficulties, created a great impression on me and from that moment I had no regret whatsoever that I had chosen to become a Veterinary Surgeon and that I had elected to pursue my course of studies at Camden Town. As the work unfolded itself I was more and more in love with it under the succession of excellent teachers which we had at that time. I thought that my fellow students were the nicest body of young men that could be found anywhere. I was very happy and always reluctant to see the end of term."

From that very first day his whole life was to be devoted, indeed dedicated, to the Veterinary profession. Edwards concentrated all his will upon the task before him from the moment that he entered the Camden School. His undergraduate career was a distinguished one, as the records of the professional and class examinations show: July, 1908, Class A, First Class Honours; July, 1909, Class B, Pass; July, 1910, Class C, First Class Honours; July, 1911, Final Examination, Second Class Honours. He showed equal proficiency in the academic and practical spheres. His extramural teachers, Campbell Hill, Hughes, of Oswestry, and W. S. King, of London, held him in high regard. King often said that the tragedy of Edwards' life was that he left practice to submerge himself in the confines of a laboratory.

While at Camden Town he won the Fitzwygram, the Williams and the Walley Memorial Prizes of the Royal College of Veterinary Surgeons.

After graduating M.R.C.V.S., he spent a short time with W. S. King in

a London horse practice, and whilst there he was invited to join Sir John M'Fadyean's staff in the laboratory. King did his utmost to dissuade him from this venture, but the call was there and he answered it. He became the junior member of a team, M'Fadyean, Sheather and Edwards, which brought great renown to the Camden School. He bubbled with enthusiasm for the work, his inherent ability was equalled by a supreme competence, and he almost became espoused to his job. The days were not long enough for him and he would often continue to work throughout the night as well. The latter was a habit which he never lost and there is no doubt that in time it had deleterious effect upon his robust physique.

In 1912 he was awarded a Jubilee Memorial Scholarship by the R.C.V.S. He spent a year at Alfort and at the Pasteur Institute and on his return he was appointed Junior Assistant in the Department of Pathology at Camden Town. At this time this department was the vital centre of veterinary research in Britain and M'Fadyean was famed far and wide as a great teacher and research worker. The research programme included investigations upon Tuberculosis, Joint Ill, Abortion and Distemper. The field was wide and provided a good training ground under superb direction. In a little over a year all this was to be interrupted by the onset of the 1914-18 Great War.

Edwards was a great patriot and much as he loved his work in the laboratory he thought that it was his duty to offer his services in the field. He volunteered for service in August, 1914, being gazetted Lieutenant in the Special Reserve of the Army Veterinary Corps.

He served under Brigadier (subsequently Major-General) Sir John Moore, who held him in high regard as an efficient and capable Veterinary Officer, and went to France with the British Expeditionary Force. He was awarded the Mons Medal and bar and was mentioned in despatches. In 1916, when a captain, he was recalled from the forces to replace Dr. Sheather, who had been appointed to the post of Director of the Institute at Muktesar, and to continue with the research work on Distemper, Contagious Abortion and Joint Ill in foals, then being conducted by Sir John M'Fadyean. He also assisted in the teaching of the department, being responsible for the Protozoology and the Helminthological Section. He brought a tremendous enthusiasm to the work and was a great inspiration to his students. Large numbers of agglutination tests poured into the department and they to be done on the day they were received, even on Saturdays and Sundays. J. T. could always be relied upon either to help or carry out all the work no matter what might be the day or time of arrival. This often involved all night sessions. At this time he was appointed Editor of the *Tropical Veterinary Bulletin*. This work had to be done in the evenings and was a further great burden to be borne by a man already taxed to the utmost. In addition, he felt that it was his duty to act as " Unofficial Host " to the many visitors to the College in those momentous days, and somehow he found the time and money, his own money, to entertain them.

In 1920, after the war was over and things were returning to a more normal tempo, it was decided to create a new department in the College, one

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which would deal with all those matters circumscribed by the title Hygiene. Edwards was appointed to the Chair. It was soon evident that, whilst he still continued his pathological research studies, he realised the value and importance of the new discipline. He set about its organisation with great vigour and there is no doubt that had he not been called to India in 1921 the name of Edwards would have ranked high in the realm of Hygiene.

During the years 1919-1921, whilst Edwards was Sir John M'Fadyean's chief assistant a group of young men were training in the laboratory. All these men have since achieved eminence in their profession. One of them writes: " We looked upon Edwards as our leader. Even at that time he had an encyclopædic knowledge of the literature. In spite of his many burdens he could always find time to discuss our difficulties with us and make suggestions as to the problems we might undertake and how to pursue them. A young man coming under his influence during that period was indeed fortunate. He had before him an example of a hard-working, tireless and enthusiastic research worker who had a real understanding of the perplexities and aspirations of a newly-fledged graduate."

In 1921 he was appointed Director of the Imperial Bacteriological Laboratory at Muktesar, in India, in succession to Dr. Leslie Sheather.

Here was a field with great scope for large-scale biological research which could embrace all facets of veterinary and medical science. He took advantage of this opportunity and during the next eight years Muktesar vibrated with his presence. Great work was done, particularly on rinderpest and surra, work that has been of incalculable value to the world.

To the great sorrow of his colleagues in India, Edwards returned to England in 1929. In the words of one of them: " He went to Muktesar to take charge of an institute when it appeared to be engaged in the uninspiring humdrum of routine work. He lighted a spark of originality which fired the place to life. A visitor to the Institute in the latter days of Edwards' tenure of the post felt the Institute to be pulsating with the enthusiasm he evoked in his Indian workers. He is remembered and spoken of with gratitude in that country."

Another colleague in India says: " He was tireless, a human dynamo and his enthusiasm was boundless . He must have slept occasionally, but one was never aware of it. The simplest request for help would bring immediate reply with an immense contribution, carefully documented as to references and running into many pages of typescript. His influence on the Indian students in particular was tremendous and still lives on at M'sar." An officer who was Director of Remounts in India adds his tribute: " He did a wonderful job and gave us great service on many occasions. I received a telegram from one of my officers in charge of a Remount Depot saying that they had 200 cases of surra, and as at that time there was no known cure it was proposed to destroy all the affected animals. I contacted Edwards and he immediately arranged for treatment by means of a spinal injection. The result of his intervention was that all the 200 horses were saved from destruction and were ultimately issued to the Army. For

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J. T. G. EDWARDS

As a young man

As a soldier

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J. T. G. EDWARDS
A recent photograph

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this wonderful piece of work Edwards received a letter of thanks and appreciation from the Indian Government."

Edwards, like many men of genius, chafed against the shackles of bureaucracy and, as everyone knows, India was the very temple of that cult. He made the mistake in thinking that government administration was shaped to follow in in the wake of scientific discovery and to facilitate its implementation in the field. It would have been a mistaken idea in any country but in India it was a "high aggravation" and the bureaucracy reacted. A few comparatively unimportant administrative lapses, made concientiously in the interests of the Institute, jarred the even working of the sterile official mind. The resulting unpleasantries, which many men would have ignored or treated with some placebo, Edwards considered to be a reflection upon his honour, and in spite of the personal attempts of the highest in the land to pour oil on the troubled waters he tendered his resignation. It is difficult to assess what the loss of this man has meant to India and to the world. Never again was he to have the scope which his genius demanded and deserved, and never again was he to have the opportunity of leading a band of devoted disciples in great crusades of scientific discovery.

When he returned to England in 1929 he joined the staff of the Foot and Mouth Disease Research Committee at the Lister Institute. In 1933 he was transferred to the Research Station at Pirbright, where he remained until he reached the age of 60 and compulsory retirement. It is said that "a prophet is not without honour except in his own country" and this can be said with truth of Edwards after his return from India. Here was an outstanding man who had made an indelible mark in the progress of science and to the honour of his profession, yet he was denied the recognition and appreciation which he rightly deserved of his own countrymen. He was relegated to subservient posts such as are occupied by junior assistants and he had fain to accept them in order that he might live.

His sensitive nature rebelled; he was under great physical and mental stress and there is small wonder that he became obsessed with an oppression complex which tore his tortured soul wide open. His friends were worried, but he fought back, and by taking an interest in a wide variety of subjects, as well as in the task by which he earned his daily bread, he wrought his own salvation. His interest in Veterinary History and Literature was a haven for his great intellect, his energy and enthusiasm. In this particular field he achieved pre-eminence and he was accepted as the legitimate successor to Sir Frederick Smith.

J.T. was a very active Fellow of the Royal Society of Medicine, and he served as President of the Comparative Section of that body. His interests were so wide that he was probably the most regular attender of the meetings held at the Society's house. He could enter into the discussions on subjects which did not come directly within the veterinary ambit and his words commanded attention always. The same attribute was very evident at meetings of the Veterinary Research Club and the Central Society. In these meetings in the presence of his fellows he was an acknowledged "elder statesman" of great

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vision and experience to whom the young could turn for inspiration and to whom all could go when they were perplexed.

He delved also in the realms of psychology and particularly on the study of animal behaviour. He took an active interest in the day-to-day affairs of veterinary endeavour and contributed much to the store of knowledge by taking part in the discussions at veterinary meetings. Veterinary politics also occupied his attention and he was elected to the councils of the R.C.V.S. and B.V.A. and took a leading part in the deliberations which led to our schools being absorbed into the university system.

Early in 1946 he was invited by the Egyptian Government and the authorities of the Fuad I University to inspect and make a report upon the Veterinary College at Giza. It was anticipated that this duty would take about three months. When he arrived a severe outbreak of rinderpest was spreading through the country and the Egyptian authorities being cognisant of his special knowledge of this disease asked for his help, which was given readily and with good result. This interruption of the original theme of his visit meant that he remained in the country longer than had been anticipated and he did not return to England until March, 1947. The terms of his original appointment as visiting Professor were enlarged, and for a time, in order that he might implement some of the recommendations which he had made, he served as Dean of the Faculty of Veterinary Science in the University. For his services he received the thanks of the University Council and of the Minister of Agriculture " for all the good work you have done for the School and for the Veterinary Services of Egypt." He was received in audience by King Farouk, who expressed his personal thanks and bestowed upon him the Order of the Nile (Third Class).

Services to Veterinary Literature and History

When he was a schoolboy Edwards gave the first signs of an exceptional command of the English language and he distinguished himself in English History and Literature. There can be no doubt also that his association with Sir John M'Fadyean, who was a master of these arts, served to develop these inherent gifts and bring them to maturity and perfection. The veterinary literature on the English language during the last 40 years gives ample evidence of his talent. Like most Welshmen he was voluble in speech and had a fine command of words, but for many years his speech did not match his pen in clarity and penetration. This was because he could not curb his enthusiasm and in consequence his thoughts outran his words. In the latter part of his life he was able to synchronize his words and thoughts to an eloquence that was superb. Veterinary literature has been embellished by his pen to a greater extent than by any other since the time of Youatt. His style was that of Macaulay and Gibbon. His writings cover a wide range of subjects and his output was prodigious, in spite of the fact that he experienced physical difficulty, for his hand was subject to a mild form of " writer's cramp " and every now and again he had to lay aside his pen and rest. The bibliographical list which

is appended to this memoir gives some idea of the extent of his contributions to Veterinary literature and to the store of knowledge.

The Man

I knew J. T. for over 30 years. He was my teacher, who in latter years became a dear and intimate friend. I witnessed his passage from the ebullience of youth to the mellowness and sagacity of mature years. I saw him with the world at his feet, and to my sorrow I lived to see him the victim of an outrageous fortune which he of all people did not deserve.

As a young man he was extremely handsome, dark of hair, a fine profile, lithe, well-built and vibrating with vigour. As the years and sorrow took their toll of his body and he put on weight, his facial appearance and intellect became that of a seer possessed of some magnetic quality that attracted disciples.

He knew the good things of life, he could enjoy those good things: good food, good wine; yet he could and did show for many years a complete disregard for creature comforts and he could content himself in his garret doing his own simple domestic chores and preparing and cooking his own food. He loved the company of his fellows and nothing gave him more pleasure than to act as host even if it was to a meal cooked by himself in his lodgings.

He was a conversationalist who could enter into discussion and sustained argument on an extraordinary range of subjects, his command of words was superb and he could have held his own amongst the celebrities in any salon. He seemed to have a contempt for the clock, quite often to the discomfiture of his friends. In his latter years he could not keep to fixed times, for he found that he could work best only when inspired. Then he would work on and on day and night without cessation and with little thought for creature comforts such as change of clothes, bed or food. He would become dishevelled in appearance, but when he had completed the task in hand he was soon aright again.

He spent many a Christmas in my home and it was a delight to have him with us. At our parties he held the centre of the stage so much that one was embarrassed, for guests, young and old, seemed to forget that there was such a thing as a reasonable time for departure. We were never quite sure when he would arrive; he was supposed to appear on Christmas Eve. One year there was no sign of him but he eventually turned up at 2.30 on Christmas Day. He explained that on the previous day he suddenly thought that he would like a "Welsh Dresser" in his room. He procured some boxes from his grocer and a hammer, saw and nails from another shop, and set about his task in carpentry. He worked all the afternoon and evening and completed the job at 4.30 on Christmas morning. This was the reason for his late arrival for as a result of his intense efforts he had slept on until noon. When asked if the other people in the house had not objected to his hammering in the night he said, with great innocence: "My landlady seemed to be annoyed with me this morning."

On another occasion when we expected him to join us he telephoned my wife on Christmas Eve. He asked her to excuse him from coming for he had

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some urgent work to do for the "Record," he had just got the inspiration and he must get down to the job. He came to us on December 27; the job was completed, but he had not been in bed or gone out for food since Christmas Eve.

J. T. Edwards was a man of great intellect and erudition; academically he was a lion amongst his contemporaries, but he was a child at heart. He was kind and courteous, and he was a man of great sentiment, deeply interested in his fellow men. He was a good counsellor and friend to all in trouble and distress, yet he could not apply these great attributes to his own personal circumstances, and he had great courage, which was manifested in the stoical way he bore the blows of fate and in the manner in which he could fight for any cause which he considered to be just. Sometimes in discussion he would appear to be cynical on matters appertaining to religion, but I think this was simply a pose, for deep in his heart he held to the beliefs learnt at his mother's knee and in the Baptist Chapel at Bury Port, and few Sundays passed without a visit to some place of worship.

His life was a tragedy. Blessed with great ability and industry he rose to the heights and achieved much, then Fate ceased to smile and he knew disappointment and despair. Let us hope that those to come will be more conscious and appreciative of his genius than were many of his contemporaries. His name will rank high on the golden roll of those who have done much for the good of the world.

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J. McC.

REPORT

The Second International Congress of Physiology and Pathology of Animal Reproduction and Artificial Insemination

Copenhagen, July 7—11, 1952

By D. L. STEWART, M.R.C.V.S.

THIS Congress was held in the Royal Veterinary and Agricultural School, and 40 countries were represented by 289 members (46 from Britain) who together with the Dutch representatives, made an attendance of 400. There were plenary sessions and sectional meetings, and the subjects were grouped under four main headings. Interesting communications in each group are referred to below.

I. THE PHYSIOLOGY OF REPRODUCTION

Thibault (France) and Walton (U.K.) gave the opening papers and reviewed recent work on the physiology of the male and female gametes, the latter speaker emphasising the need for further investigation into the *in vitro* survival of germ cells and into the motility and the metabolic rate of spermatozoa.

W. Sokolowskyj (U.S.A.) made some interesting observations on the behaviour of bulls in the course of which he described the case of a bull, which although castrated at one-and-a-half years of age was still able to cover a "dummy" cow at any time and retain the ability for orgasm one-and-a-half years later.

Ortavant (France) showed that the number of spermatozoa in the testicle of the ram was directly related to the weight of the testicle and that the sperm reserves depended on the number of spermatozoa actually in the testicles. If this work could be applied to other species it might provide a quantitative method of studying the factors affecting spermatogenesis.

While establishing a correlation between the light reflecting capacity of bull spermatozoa and fertility, Lindahl and Kihlstrom (Sweden) found a protein in seminal plasma capable of preventing the agglutination of spermatozoa. This development may prove a valuable lead as the agglutination of spermatozoa is an occurrence which from time to time causes much concern in the practical application of artificial insemination.

The transportation by air of fertilised rabbit ova from the U.S.A. to Britain (Marden and Chang) and the subsequent successful transplantation of the ova into recipient does provide grounds for much speculation into the future of ova transplantation in cattle. However, Lamming and Rowson (U.K.) who reviewed work in cattle and described the results of their own investigations were not encouraging. They found difficulty in fertilizing ova produced by the induction of superovulation, in recovering viable fertilized ova from the live cow and discovered that, owing to infection, it was impossible to transplant fertilized ova in the cow by any method that did not involve laparotomy. The report of Willett (U.S.A.) was also discouraging since he had found that dairy cows became refractory in their response to the repeated administration of gonadotrophins for producing superovulation.

Marden (U.K.) described experiments in which he showed that from birth the ovaries of the calf were capable of responding to gonadotrophins; this is unlikely to have any practical application at the moment, but is of interest to research physiologists.

II. The Pathology of Reproduction

This session was opened by Asdell (U.S.A.), who described the co-operative effort on the sterility problem of cattle being made under a Technical Advisory Committee in the north-eastern region of the U.S.A. In particular he referred to the survey work of the New York Mobile Laboratory which had led to the conclusion that management factors together with disease factors were of major importance. Asdell quoted from committee reports whose chief points were that there was a low repeatability and low degree of hereditability in the fertility of dairy cattle and that poor calfhood nutrition was followed by late puberty and difficulties in parturition but it did not affect the ease of conception under the conditions of the experiment.

The paper by Laing (U.K.) reviewing and discussing the work on early

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embryonic mortality was considered by many to be outstanding. He drew attention to the high incidence of this condition in cattle and pigs and to the fact that in all cases the ætiology was obscure.

During the sectional meetings three papers were presented by Swedish workers on genital malformations of genetic origin. The greater part of the findings were confined to the Swedish Highland breed and abundant evidence was presented; similar genital defects have not been recognised in other countries.

The German workers, Schoop and Klette, described a severe outbreak of sterility in a herd due to the presence of œstrogens in the pasture grasses. Their work appears to have been done carefully and is the first report of its kind in Europe.

Trichomoniasis did not figure prominently in the discussions but unusual results were reported by Jahnel (Austria) who, using a simple technique found Trichomonads in mucous taken directly out of the uterus or cervical canal in 31 cows (27 were *in œstrus*) out of 88 suspected, and by Vandeplassche (Belgium), who reported success in the treatment of 30 out of 34 bulls affected by Trichomoniasis by using a method similar to that of Abelein. Microscopical and cultural methods were employed to assess the efficiency of the treatment.

Brus (Netherlands) drew attention to the difficulties of interpreting the findings in uterine biopsy in the cow, but further study is indicated and uterine biopsy might be of value in research and in the solution of practical problems.

II. Artificial Insemination

The subject matter under this heading fell into two categories, *Vibrio fœtus* infection and artificial insemination. Reviews of the work done on the former were given by Sjollema (Netherlands) and Lawson (U.K.), the latter reported the results of the Weybridge experiments and these were of great interest to the Congress.

Five other papers referred to *V. fœtus* infection: Albertsen (Denmark) established by *in vitro* experiments that in the presence of 25 per cent or more egg-yolk, 1,000 units streptomycin per ml. in diluted semen did not kill pathogenic bacteria at 5° C. (the usual storage temperature for semen used for A.I.), but had some effect at 25°-30° C. Flatla reported on the Norwegian investigations on *V. fœtus*; the clinical condition had been reproduced in a few experimental heifers and the organism appeared to be sensitive *in vitro* to several antibiotics. Adler (Denmark) found that of 14 bulls in A.I. stations submitted to transmission tests in which 6-10 virgin heifers per bull were used for test mating, eight were carrying *V. fœtus*. The positive reaction to the vaginal mucous test was the criterion of infection. (Later, information given by Rasebech revealed that out of 150 bulls on A.I. centres examined for *V. fœtus* by transmission tests, 30 were shown to be carrying the organism.) Rasbech (Denmark) found that in bulls the Vibrio is situated mainly in the preputial sac but that infection may also arise from the urinary tract. Finally Adler and Rasbech (Denmark) found that streptomycin raised the fertility level of A.I. centres by the effect of the antibiotic on individual bulls and all the bulls shown to be

capable of transmitting *V. fœtus* came within the group showing the beneficial effect.

From the foregoing the need for further experimental work on the *in vitro* and *in vivo* effect of antibiotics on *V. fœtus* is evident, particularly with reference to the use of antibiotics in semen diluents. The tampon method used by the Danes for obtaining mucous samples should be investigated as it might prove more convenient, or possibly more effective, than that at present employed in Britain.

Anderson (Kenya) gave a comprehensive review of the published work on the examination of semen and its relationship to fertility but there is no effective laboratory test for semen quality and this was illustrated by the criticism made against the paper by Gassner (U.S.A.) on the fructolysis of semen.

The possibilities of long-term storage of semen at —79° C. were outlined by Polge and Rowson (U.K.) and provoked much interest, but although a pregnancy rate of 79 per cent on 38 cows in their preliminary report is promising, it is obvious that a great deal of work will be required on this subject before it becomes a practical procedure.

An interesting observation of Salisbury and Van Demark (U.S.A.) was that live or dead spermatozoa ascend the reproductive tract of the œstrus or post-œstrus cow in less than 2.5 to four minutes, and Dauzier and Wintenberger (France) found that spermatozoa took eight hours to ascend the genital tract of the ewe; these findings require further investigation. Two papers showed that there was no difference in the conception rates resulting from insemination at the intra-cervical and intra-uterine sites respectively, when the recto-vaginal technique of insemination was used but that there were definite advantages in favour of the former site. Other interesting communications on A.I. were the report by Jacquet (France) of favourable results using milk as the basis of the semen diluent and by Willett (U.S.A.) who indicated that 1 : 100 was about the maximum extent to which semen might be diluted on cattle-breeding centres without loss of fertility.

IV. Animal Nutrition and Fertility

This subject was discussed at a joint meeting organised by the Sixth International Congress of Animal Husbandry. Papers were presented by reporters from different countries and were so generalised that the discussion rarely reached sufficient depth to interest specialists in fertility work. The meeting showed clearly the need for more experimental work on the relationship of nutrition to fertility. The only papers based on experimental work were those of Moustgaard (Denmark), who showed this relationship between vitamin B_{12} and fertility in sows and, of Salisbury and Lamming (U.S.A.) who had observed that incipient vitamin A deficiency in rats interfered with fertility.

V. General

The Second International Congress of Physiology and Pathology of Animal Reproduction and of Artificial Insemination was considered to have been very successful by all who were present; the organisation was efficient yet unobtrusive

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and the informal atmosphere of the College allowed close contact to be maintained between members. The use of three official languages tended to limit discussion during the official sessions but there were excellent opportunities for informal discussions outside the formal meetings. The 71 communications were of a high standard and the 14 papers given by the United Kingdom representatives were particularly good.

It is evident that a small specialised congress brings together those people actively engaged on the subject and the value of the meetings is enhanced by the high level of the discussion and the attention given to matters of detail; at a large more generalised congress very little detail is ever discussed. The two congresses held conjointly in Copenhagen presented an interesting contrast in this respect and the Sixth International Congress of Animal Husbandry, despite the efficiency of the organisation and the excellency of the hospitality, was not considered a success by those actually working on this subject.

Unfortunately the Second International Congress of Physiology and Pathology of Animal Reproduction and of Artificial Insemination is not fully recognised internationally and this caused concern at the closing meeting when the location of the next Congress was discussed. It was resolved that the help of F.A.O. be sought in achieving such status in order to facilitate the holding of future congresses. Having regard to the obvious value of the work of this congress, I feel no doubt that Britain should lend full support to F.A.O. in this matter.

The Sixth International Congress of Animal Husbandry Copenhagen, July 9—14, 1952

This Congress was efficiently run and well attended and there were 698 members (including 264 Danes) representing 34 countries. At each session a general subject was discussed and the papers, each consisting of a general report and several special reports, were given by individuals from different countries.

In most of the reports the subject was dealt with in general terms and rarely were details given or experimental data quoted. Consequently the quality of the discussions was poor and was not improved by a breakdown of the system providing for simultaneous interpretations at the meetings. The following is a brief account of the subjects discussed.

I. Present Viewpoints on Breeding Methods. Pure Line Breeding and Cross-Breeding

There was considerable discussion on this subject but, although a few points were put forward, no conclusions were reached and it appeared ultimately that there was little to be gained by cross-breeding confirming the livestock policy of our own Ministry.

II. Fundamental Issues of Modern Physiology Concerning the Vitamin B Complex

The good general report by Mollgaard (Denmark) made it the most inter-

esting session. He criticised the over-simplified experiments of the Americans, and stated that it was not enough to know that certain antibiotics gave apparent weight gain in some species; it was essential to know how the antibiotic acted and whether similar results could not be achieved by devoting more attention to good hygiene and animal health.

III. Animal Nutrition and Fertility

The material presented and the quality of the discussion were poor. The main points are discussed in the report of the Second International Congress of Physiology and Pathology of Animal Reproduction and of Artificial Insemination.

IV. Methods of Calculating Costs of Animal Production

This session was dull as each reporter gave an account of his methods which did not seem to differ appreciably from those of any other reporter.

V. Advisory (Extension) Service in Animal Husbandry

An outline was given of the advisory services in several countries. There was little or no difference between the reports and one was left wondering if they were all as efficient in practice as they appeared to be on paper. The British service was ably described by Wannop and his report was typical of those presented.

VI. General

The main achievement of this Congress was to bring together a large number of people from different countries thereby affording them an opportunity of becoming acquainted and of exchanging views. In the past it has been unfortunate that Britain has not been a member of the European Society of Animal Production, who have sponsored this congress, but it is understood that she will probably be represented in the future when her influence should make for improvements in these congresses.

Already there are indications that at the next congress the programme will consist of plenary sessions and sectional meetings, allowing time for both general and specialised papers. Preliminary reports of research work in progress which would be included, would be of particular value.

REVIEWS

The Bloodstock Breeders' Review. An illustrated annual devoted to the British Thoroughbred. Vol. XL, 1951. British Bloodstock Agency, 26 Charing Cross Road, W.C.2. Price £3 net.

Volume 40 (1951 of the *Bloodstock Breeders' Review* is to hand, filled as usual with information about thoroughbreds at home and overseas. The story of the racing year is told by Bernard O'Sullivan and James Park, the former dealing with the classic and weight-for-age races, and the latter with the two-year-olds, handicap events, sprinters and National Hunt events. It is pleasant

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whilst in the armchair to review in retrospect all our cherished hopes and theories of 1951, for these two writers by their gifted race readings and analyses are able to make those events come to life again and their selections of illustrations enhance the historical value of the work.

Veterinary surgeons will be interested in the first three pages in which O'Sullivan deals with "doping." Of recent years this topic has been much to the fore and in certain ways it has been the cause of much comment and concern amongst professional men. Whilst all deprecate the administration of any drug which would affect the running of a horse there are many who are of the opinion that trainers do stand in far too great a peril under existing circumstances when they have to accept that certain drugs have been found and identified, often in very minute amount, and yet they have no opportunity of finding out how the results were obtained.

There is a good report of the Thoroughbred Breeders' Association 35th Annual General Meeting.

Two important items were amongst the subjects discussed, Transit by British Railways and Identification of Thoroughbreds, both of supreme interest to veterinary surgeons. Both are by no means as good as they might be by modern standards and it is good to see that this influential body is taking active steps towards an improvement.

Pages 124-353 are devoted to reviews of racing overseas, including Ireland, and it is evident that British stock and their progeny are still well to the fore. Geneticists will read with interest Cedric Borgnis on Inbreeding in the Derby Winners, 1851-1951.

Biographies of racing men who have passed on seem to be more numerous than usual to our great regret for many of these men were unique personalities and great stalwarts of the turf.

The review of bloodstock sales is heartening, no doubt influenced by the turf successes of British bred stock. In a time of falling values of all commodities, such as was beginning in 1951 and has continued since, it is refreshing to note that 1951 compared very favourably with 1950. Good things always command a fair price so we must reckon that British bloodstock is still considered to be a good investment. The terminal part of the text is devoted as usual to statistical analyses of such things as Sires of Winners, Dams of Winners, Sires of Sprinters and Stayers, Fertility Rates, etc. Here is material to occupy the thoughts of the armchair expert as well as the professional for many hours.

He can muse and argue to his heart's content and, who knows, he may solve the problem of how to breed the certain Derby winner.

We have said on previous occasions that it is really difficult to review this book for it contains such a wealth of material compressed into such small bulk. It is a book one can turn to at any time, open at random and immediately find matter of compelling interest. It will give interest and pleasure to the novice and the theorist, it is essential to the expert. It is a handsome book, full of beautiful illustrations and valuable information on all matters appertaining to British bloodstock.

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MEMOIRS OF A VETERINARY SURGEON, by Reginald Hancock. Illustrated by Elaine Hancock. London: Macgibbon & Kee, Ltd. Price 15s.

MEMOIRS and autobiographies are interesting for the author, as he passes along the winding road of life, gives to the reader a panoramic view of the changes which have occurred in the mode of life and in the country during the period under review.

No profession has been more subject to change than has that of the Veterinary surgeon during the last fifty years. It is as if a revolution had occurred, a revolution which has its repercussions not only in the type of work to be performed but also on the type of student entering our colleges. The premises from which the Veterinary Surgeon practises his art are different and this difference even extends to the very smell of the pharmacy. Gone are the pungent and aromatic odours which pervaded the place, issuing from mahogany drawers which contained the vegetable and other powders which were the main stand-by of his armamentarium.

The author's schooldays are reminiscent of Tom Brown's schooldays or the fifth form at St. Dominic's. A stern Victorian father, cane-swishing masters, rigid discipline and a timid boy. His experiences are not unique and no doubt they will bring man ya sentimental tear to other surviving victims, for fortunately time is a great healer and the trials and tribulations of the past are apt to glow benignly when viewed in retrospect. He was luckier with his tonsils than were my brothers. Their ordeal was saved for a vacation, for schooling was expensive and could not be missed. In turn I saw my three elder brothers submitted to the tender mercies of the local "saw bones," who applied the guillotine without an anæsthetic. In turn I saw them depart to the surgery on their cycles, a four mile journey, and come back ejecting blood over the handlebars. I lived in constant fear of the time when I would be called to do the journey, but thank God the occasion never came and I still possess those beneficial and protective structures. I have wondered why some men became Veterinary Surgeons. I have questioned many students, but the author gains precedence over all when he intimates that an aversion to emasculation drove his ambition from a choir stall at Canterbury to the ancient school at Camden Town. He gives a good picture of the old type public school where tradition and discipline reigned supreme and grey matter was stimulated reflexly by stimuli applied cutaneously to the rear portions. And then he came to Camden Town.

Was he the only public school boy? Of course not. Was the scholastic standard at that ancient institution so low? Of course not. A cross-section of the students at that or any other time would show that they compared very favourably with the undergraduates of any other learned profession. The author, quite justly, has a very high opinion of Sir John Macfadyean but I think that such men as Macqueen, Pemberthy, Woodruff, Buckmaster, Shane, Lander and Wooldridge were each and all of equal eminence in their own particular line and could have held their own in any company. The fame of Camden Town was founded to a great extent on the quality of all the teachers.

He qualified just in time to enter the forces in that year of destiny, 1914,

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and to serve throughout the war. He gives a good picture of the life of a Veterinary Officer in the field in the days when that officer was a man of great importance in military life. He was more fortunate in his postings than were most temporary officers and on one occasion he "stood in" for royalty. Having been carried to such heights his return to civilian status was not easy, but he was again lucky for there was the family practice and he had a job to go to.

One cannot help but feel that he was a square peg in a round hole. He was a Veterinary Surgeon but his heart was in music and the drama. I think at this time his heart was so troubled that he might have hazarded the perils of the journey to the choir stall. He is too critical and a little unfair to Bill Anderson. Bill was a good Veterinary Surgeon albeit a showman. He gave great service to his patients and clients. He used his showmanship to soften many anxious and distressing moments for his clients and patients. It is small wonder that he was loved and respected in Uxbridge and his progress down the street was quite a cermony, for he was greeted affectionately by all.

We read how the author conquered his inhibitions and distaste for veterinary practice and how he was at last able to settle down and make a success of his professional life. Those who know Reg Hancock will revel in his chapter on "Wizardry" and the "extrasensory perceptions" of the exponents of "mumbo jumbo" or "Abracadabra" healing.

In this connection it is interesting to note that the services of such "physicians" are in demand in East Africa and under official recognition. No doubt a "Witch Doctors'" college will be established in the near future and the curriculum will include many mystic signs and wonders not forgetting the ritual of sucking a goat's foot. We hear of the author's unexpected and rapid rise to fame on the council of the professional association and his levitation afterwards to the higher spheres of Jermyn Street.

When he went to the 1936 N.V.M.A. Congress, as deputy for his father, Reg Hancock could have had little foreboding of the great turn in his life that was to occur. He accidently, or almost accidently, met his Scarlet Pimpernel who was to guide him up the steps of fame and bring him into contact with a man who would facilitate and complete his escape from veterinary practice. This is a good story of a man's life, it gives a picture of veterinary life during the last half century, and Veterinary Surgeons who read it will gain much in pleasure and understanding. The illustrations are by the author's talented daughter, Elaine.

VETERINARY ANÆSTHESIA: THIRD EDITION, by J. G. Wright, M.V.Sc., F.R.C.V.S. Pp. viii + 268. 72 illustrations. London: Bailliere, Tindall & Cox. Price 21s. net.

CAUTION must ever be a watchword in any treatise on anæsthesia. New anæsthetic agents are always welcome but it is essential that they be put to clinical test in the field before old and established—even though not perfect—methods and agents are discarded. It is not always wise to accept and copy new

anæsthetic techniques as used in the human operating theatre and regard them as wholly applicable to veterinary patients in the field. It is well to remember also that the achievements of the experimental surgeon and the physiologist cannot be accepted always at their face value by clinicians without extensive trials in practice. The requirements and results may suit one but not the other.

In this new edition of a book which is unquestionably a standard work in the English-speaking world the author has a difficult task in appraising new methods for he has the onerous duty of sifting the oats from the chaff so that his readers can accept and practise what is written with confidence and satisfaction to himself, his patient and his client.

In reviewing this present edition it is necessary to contribute this preamble because there have been no startling advances in veterinary anæsthesia and much of the new material in the book is treated, quite rightly, by the author with reserve. Endotracheal anæsthesia dates from the sixteenth century but the greatest advance came when Magill introduced his intratracheal tube in 1914. It is only within the last decade that this form of anæsthesia and intubation have been utilised in veterinary patients. With the advent of the antibiotics the veterinary surgeon has become more venturesome and the value of intubation in thoracic surgery is obvious irrespective of the anæsthetic agent employed.

In respiratory failure, particularly in the brachycephalic breeds of dog, intubation with a Magill tube has decided advantage over the hastily introduced piece of gas tubing. It may yet become commonplace to intubate cattle undergoing protracted surgical interference in recumbency, in order to avoid the not unknown and usually fatal sequel to reflux of ruminal content.

Additions to this book can be summarised as follows:—

In the previous edition cyclopropane gas as an anæsthetic for small animals received consideration. In the present volume its use has been extended to sheep and goats.

Chapter 18, which deals with inhalation anæsthesia in the dog and cat, discusses the properties and administration of Trichlorethylene (Trilene). In the same chapter Ethyl Chloride receives fuller mention and new apparatus for the induction of ether and chloroform anæsthesia has been included.

New material in Chapter 20 on the use of pentothal sodium in the narcosis and anæsthesia of equidæ indicates increased confidence in the use of the barbiturates in this species but their adoption has not yet received universal popularity on account of the occasional dangers of idiosyncrasy to the drug and possible excitement during the recovery stage.

"Anavenol" (Beta-naphthoxyethanol) and "Anavenol"-K are discussed at some length and without bias. The author is not happy about this agent. He relates his experiences with its use and it is not inappropriate to quote his last paragraph. "As yet there insufficient knowledge of the pharmacology of Beta-naphthoxyethanol and insufficient experience of its use in animals to assess accurately the place it occupies in veterinary surgery."

The difficulties which surround intravenous injection in the young pig are

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well recognised. The technique of injection into the anterior vena cava in this species described in Chapter 22 is a welcome addition to our knowledge.

Chapter 27 deals solely with positive pressure ventilation of the lungs during intrathoracic surgery and illustrates modern developments in technical ingenuity and surgical skill.

The use of curarising agents is not mentioned in the present edition. Myanesin and other muscular relaxants have been used in veterinary surgery and in specific operations may have a definite indication. One can well imagine that the author, a man who believes in anæsthesia in its truest and most humanitarian sense, would naturally view such agents with some degree of suspicion. We await his comments in the next revised text. This book from its inception has consisted of sound material. Its high standard is maintained in the new edition. Veterinary surgeons and their patients owe the author a deep debt of gratitude. The publishers are to be congratulated on the presentation of the book. The improvement in the paper is, perhaps, an indication of a healthier post-war era.

NEWS

THE Distillers Company (Biochemicals), Ltd., Speke, Liverpool 19, on behalf of its distributors: Allen & Hanburys, Ltd.; The British Drug Houses, Ltd.; Burroughs Wellcome & Co.; Evans Medical Supplies, Ltd.; Imperial Chemical (Pharmaceuticals), Ltd.; and Pharmaceutical Specialities (May & Baker), Ltd.; announces reductions in retail prices from February 2 of their products: Penicillin G, Sodium salt and Potassium salt (buffered); "Distaquaine" G; "Distaquaine" fortified; "Distaquaine" suspension; Streptomycin (Sulphate) and Dihydrostreptomycin (Sulphate); "Distavone."

Glaxo Laboratories, Ltd., Greenford, Middlesex, announce reduced contract terms for the following veterinary cerates with effect from February 2: penicillin, streptopen and dihydrostreptomycin. They also announce the introduction from February 16 of a 30 c.c. rubber-capped bottle of Vetostelin, containing 600,000 units of vitamin D per c.c. The new pack is intended for massive vitamin D therapy. The existing 6 x 1 c.c. pack of Vetostelin will be discontinued as from February 16.

Publishers' Notices

THE BRITISH VETERINARY JOURNAL, with which is incorporated THE VETERINARY JOURNAL, is published monthly, and copy for advertisements should be in the hands of the advertisement manager not later than the 20th of the preceding month, if proof is required. Tel.: Temple Bar 3386.

Letters for the Journal, literary contributions, reports, notices, books for review, exchanges, new instruments or materials, and all matter for publication (except advertisements) should be addressed to the Editor.

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